SUBSURFACE GAS AND IN-BUSINESS AIR SAMPLING EVALUATION REPORT

Waste Disposal, Inc., Superfund Site
Santa Fe Springs, California

FINAL

October 15, 1999

Prepared under Contract
DACW05-96-D-008 for:
U. S. Army Corps of Engineers
Sacramento District
Sacramento, California

and for the

U.S. Environmental Protection Agency
Region 9
75 Hawthorne Street
San Francisco, California

Prepared by:
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Walnut Creek, California

CDM Federal Programs Corporation
A subsidiary of Camp Dresser & McKee Inc.

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February 9, 2001

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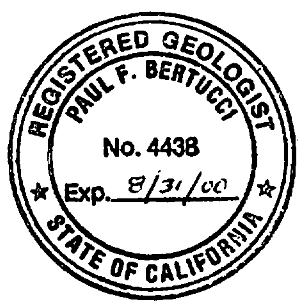
CERTIFICATION

THIS DOCUMENT WAS PREPARED UNDER THE DIRECTION AND SUPERVISION OF A QUALIFIED REGISTERED GEOLOGIST



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REGISTERED GEOLOGIST

SUBSURFACE GAS AND IN-BUSINESS AIR SAMPLING EVALUATION REPORT

Waste Disposal, Inc. Superfund Site
Santa Fe Springs, California

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LIST OF ACRONYMS AND ABBREVIATIONS

bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, and xylene
CARB	California Air Resources Board
CDM Federal	CDM Federal Programs Corporation
COC	chemical of concern
DCA	dichloroethane (1,2-)
DCE	dichloroethene (1,2- and 1,1-)
DTSC	(California) Department of Toxic Substances Control
ERT	Environmental Response Team (USEPA)
FASP	Field Analytical Support Program
FSAP	Field Sampling and Analysis Plan
GC/MS	gas chromatography/mass spectrometry
HQ	hazard quotient
ITSL	interim threshold screening level
NPL	National Priority List
NMOC	non-methane organic compounds
OSHA	Occupational Safety and Health Administration
OU	operable unit
PCE	tetrachloroethene
PEL	permissible exposure limit
ppbv	parts per billion by volume
ppmv	parts per million by volume
PRG	preliminary remediation goal
QAPP	Quality Assurance Project Plan
RD/RA	remedial design/remedial action
RI	remedial investigation
Rfd	reference dose
ROD	Record of Decision
ROI	radius of influence
SCAQMD	South Coast Air Quality Management District
scf	standard cubic feet
SGCP	Subsurface Gas Contingency Plan
SVE	soil vapor extraction

TCA	trichloroethane (1,1,1-)
TCE	trichloroethene
TLV	threshold limit value
USEPA	U.S. Environmental Protection Agency
VOC	volatile organic compound
WDI	Waste Disposal, Inc
WDIG	Waste Disposal, Inc. Group

EXECUTIVE SUMMARY

This Report presents an evaluation and assessment by the U. S. Environmental Protection Agency (USEPA) of subsurface soil gas investigation, sampling, and monitoring activities conducted during the period of 1989 through 1999 at the Waste Disposal, Inc. (WDI) Superfund site in Santa Fe Springs, California. This evaluation additionally provides an assessment of associated in-business air sampling and soil vapor extraction (SVE) testing performed during 1997-1998 at the site.

The WDI site was originally used for petroleum crude oil storage during the 1920s but was later used until the mid-1960s for disposal of a variety of hazardous substances including both liquid and solid wastes. Wastes disposed at the site include petroleum-related chemicals, solvents, drilling muds, sludges, construction debris, and other industrial waste materials. The wastes were disposed in a 42 million-gallon capacity concrete-lined reservoir and associated unlined bermed areas (sumps) surrounding the reservoir, both of which have been covered with fill soil.

The primary objectives of this Report are to:

- Evaluate the soil gas investigation and sampling results in order to characterize subsurface gas conditions at the WDI site, define areas of high concentration of soil gas chemicals of concern (COCs), and assess the extent of soil gas migration.
- Compare and evaluate the soil gas sampling results relative to interim threshold screening levels initially established by the USEPA for the WDI site and describe the approach to developing provisional soil gas performance standards for the primary soil gas COCs.
- Evaluate and compare the results of in-business air sampling with subsurface gas monitoring data to assess potential migration of soil gas COCs into on-site businesses.
- Summarize the results of recent SVE testing conducted by the Waste Disposal, Inc. Group (WDIG) to evaluate the feasibility of this technology in controlling subsurface soil gas at the site.

Subsurface Gas Characterization

Soil gas investigation and sampling at the WDI site has been conducted during 1988-1989 (USEPA Remedial Investigation), 1995 (WDIG predesign confirmation sampling), and 1997 (USEPA Subsurface Gas Investigation). Based on the results of the 1997 investigation, the WDIG installed 27 new vapor monitoring wells (16 perimeter and 11 interior locations) for the WDI subsurface gas monitoring program. USEPA installed an additional 10 vapor monitoring wells to further monitor subsurface gas conditions in the vicinity of on-site businesses. The existing vapor monitoring well network consists of 22 single-screen wells and 39 multi-level wells, comprising a total of 160 individual soil gas monitoring intervals (probes).

The soil gas sampling data collected during the more recent investigations and monitoring during August 1997 through July 1998 were used to evaluate current subsurface gas conditions at the WDI site. The following conclusions are made based on this evaluation and related site characterization studies:

- A total of 48 chemicals were detected in the 1997-1998 soil gas sampling activities. Of these 48 chemicals, an estimated 16 chemicals have been identified as potential COCs. The primary COCs present in subsurface gas at WDI include benzene, toluene, ethylbenzene, toluene (collectively referred to as BTEX), methane, and solvent-related volatile organic compounds (VOCs), primarily trichloroethene (TCE), tetrachloroethene (PCE), vinyl chloride, and related compounds. Overall, the distribution of soil gas COCs is variable across the site reflecting the composition and degradation of waste sources in the subsurface. Analyses of vapor samples from inside the buried reservoir confirm very high concentrations (typically 10,000 to 100,000 parts per billion by volume [ppbv]) of all of the soil gas COCs.

- Outside of the reservoir, methane and BTEX in soil gas occur primarily in the areas of buried wastes (chiefly drilling muds and petroleum-related wastes). During the monitoring period reviewed, these COCs were detected in vapor monitoring wells outside of the reservoir at the following maximum concentrations: methane 76%, benzene 64,000 ppbv, toluene 4,700 ppbv, and total xylenes 6,400 ppbv. Chlorinated solvent VOCs (TCE and PCE) and their degradation compounds (vinyl chloride and 1,2-dichloroethene) appear to be distributed in localized areas. During the monitoring period reviewed, chlorinated VOCs were detected in vapor monitoring wells outside of the reservoir at the following maximum concentrations: vinyl chloride 6,500 ppbv, TCE 3,900 ppbv, and PCE 1,400 ppbv.

- For this evaluation, soil gas "areas of concern" are defined as those portions of the site where one or more of the soil gas COCs have consistently been detected above the interim threshold screening levels. Figure ES-1 shows the locations of the identified soil gas areas of concern based on recent sampling of the vapor monitoring well network (February-July 1998).

- Quarterly monitoring of the vapor monitoring well network during 1998 does not indicate widespread or significant migration of soil gas COCs beyond the WDI site boundary. To date, only local exceedances of the interim threshold screening levels for methane and TCE have been confirmed at perimeter monitoring wells. During the monitoring period reviewed, no trends of increasing concentrations of soil gas COCs have been observed at the site perimeter.

Provisional Soil Gas Performance Standards

As part of this evaluation, the recent soil gas sampling results were reviewed to confirm and refine the list of soil gas COCs for the site. A chemical was determined to be a COC if, (1) the chemical was detected in more than five percent of the soil gas samples, and (2) the maximum concentration of the chemical in soil gas exceeds a comparison concentration which was derived from the 1998 USEPA Region 9 preliminary remediation goals (PRGs) for ambient air. Provisional performance standards were developed for 16 soil gas COCs by using the 1998 ambient air PRG concentrations and applying an attenuation factor of 100 to account for the estimated dilution of chemicals in soil gas to in-business indoor air. The provisional soil gas performance standards will serve as the basis for establishing remedial action and compliance standards in the final site Record of Decision.

In-Business Air Monitoring

The primary purpose of the WDI in-business air monitoring activities is to identify potential air quality health concerns that may be due to the migration of subsurface soil gas into on-site businesses or buildings. In-business air samples were collected and analyzed for VOCs and methane at all buildings at the site during the USEPA's 1997 subsurface gas investigation. No conclusive evidence of soil gas migration into on-site businesses was observed during the site-wide in-business air sampling, although the laboratory analyses detected chemicals in some of the samples. However, the initial study concluded that supplemental in-business air monitoring should be performed to verify and confirm the sampling results at the on-site businesses located near areas of buried wastes.

An evaluation of in-business air sampling results focused on the seven businesses/buildings that were selected for monthly and quarterly in-business air monitoring due to their proximity to soil gas areas of concern and buried wastes. All compounds detected in in-business air samples during the August 1997 through November 1998 monitoring were compared to ambient air background concentrations, the interim threshold screening levels, and 1998 USEPA ambient air PRGs. Additionally, the soil gas data for the vapor monitoring wells located within 50 feet of the building locations were reviewed to assess the potential for soil gas migration into the businesses.

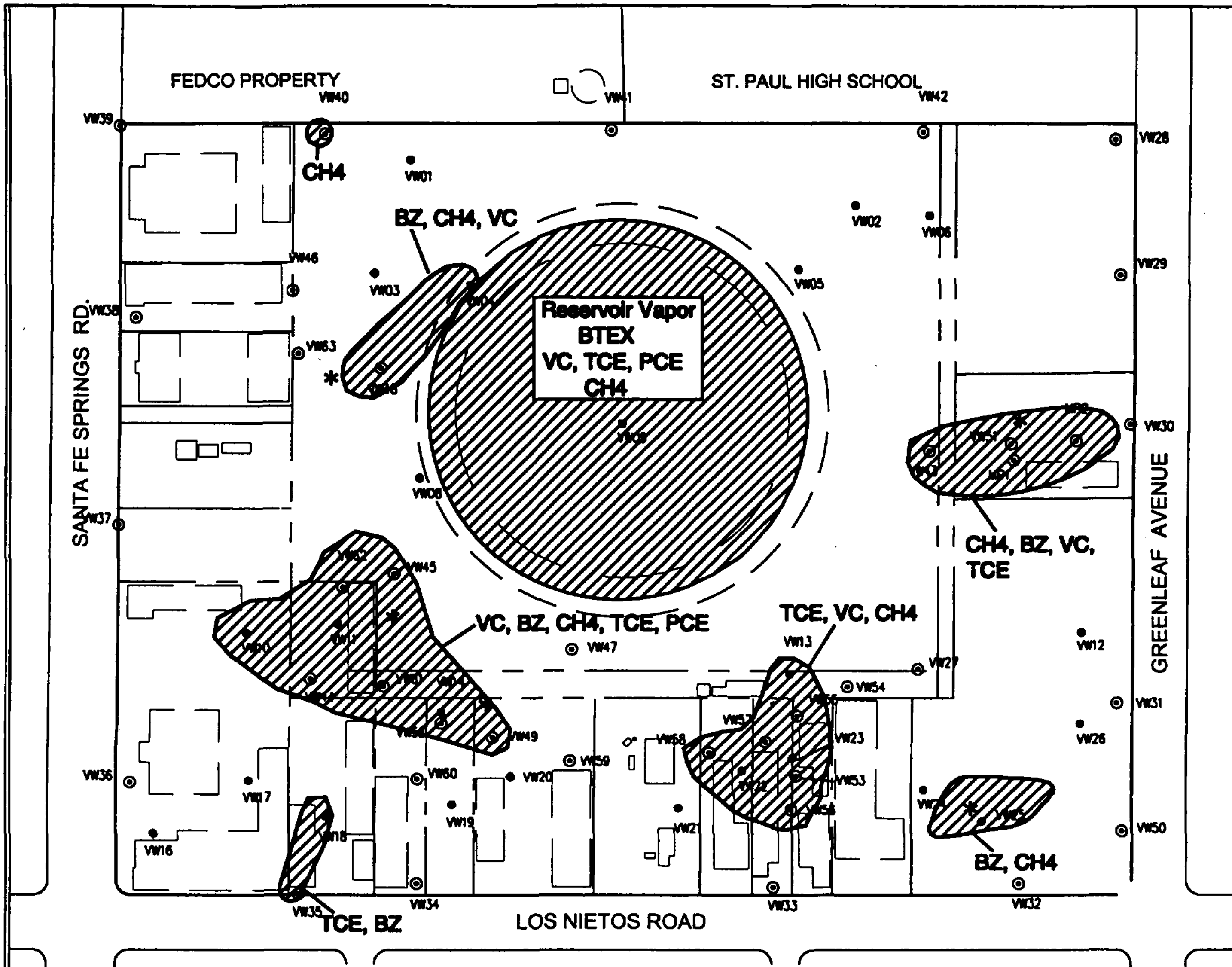
Based on the results of the in-business air sampling in 1997 and 1998, no potential health concerns due to subsurface gas migration were identified at three of the seven building locations evaluated. At the remaining four buildings, several VOCs were detected in both the in-business air samples above interim threshold screening levels and in nearby soil gas monitoring probes suggesting a potential link between subsurface gas and the in-business air quality. However, the more likely sources of the VOCs detected in in-business air samples are the industrial products and chemicals used by these businesses.

Due to site-specific uncertainty factors, the in-business air sampling data collected to date do not provide definitive or conclusive evidence of whether or not there is soil gas migration into on-site businesses or buildings. The sources of uncertainty which prevent a definitive assessment of soil gas migration into on-site businesses or buildings include: (1) the use of industrial products and chemicals within the businesses; (2) the unknown soil gas chemistry directly beneath the buildings; and (3) the potential infiltration of outside air during in-business air sampling. In-business air sampling and evaluation will continue in all businesses where the potential for subsurface gas migration exists.

SVE Testing

During 1998, the WDIG implemented a SVE testing program at the WDI site to provide site-specific data for SVE and to evaluate the feasibility of this technology as a remedial alternative for controlling soil gas at the site. The study was designed to additionally provide data regarding vapor treatment effectiveness and gas generation rates at the site. The SVE studies were conducted in five selected areas of the site.

The SVE tests at all locations demonstrated that the technology can be applied to the WDI site to remove subsurface gases, to prevent migration of soil gas away from the site, and to control soil gas near buildings. During the tests, concentrations of methane and VOCs were significantly reduced. Sampling of soil gas concentrations after the extraction was completed showed that the rate of increase relative to the pre-test concentrations was slow, indicating that the potential for gas production is less than most typical municipal landfills. The use of SVE as a gas control remedy will be further evaluated in the Supplemental Feasibility Study.



LEGEND

WDI SITE BOUNDARY

PARCEL BOUNDARY

BUILDING

VW06 SINGLE-SCREEN VAPOR MONITORING WELL

VW28 MULTI-LEVEL VAPOR MONITORING WELL

SOIL GAS AREA OF CONCERN
Approximate Area Based On
1998 Vapor Well Sampling

Primary Soil Gas Chemicals of Concern and EPA Interim Threshold Levels

VC	Vinyl Chloride	12.5	ppbv
BZ	Benzene	100	ppbv
TCE	Trichloroethene	411	ppbv
PCE	Tetrachloroethene	532	ppbv
CH4	Methane	1.25	%

N

120 0 120 240
SCALE IN FEET

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Soil Gas Areas of Concern
WASTE DISPOSAL INC.
SANTA FE SPRINGS, CALIFORNIA

Figure ES-1

Section 1.0

1.0 INTRODUCTION

This report presents an evaluation and assessment of subsurface gas investigation, sampling, and monitoring activities conducted during the period of 1989 through 1999 at the Waste Disposal, Inc. (WDI) Superfund Site, Santa Fe Springs, California. This evaluation additionally provides an assessment of associated in-business air sampling and soil vapor extraction (SVE) testing that have been performed as part of remedial design/remedial action (RD/RA) for final closure of the WDI site. This report has been prepared for the U.S. Environmental Protection Agency (USEPA) by CDM Federal Programs Corporation (CDM Federal) under Contract No. DACW05-96-D-0008 with the U.S. Army Corps of Engineers, Sacramento District.

1.1 PURPOSE AND OBJECTIVES

The overall purpose of this report is to summarize and evaluate the subsurface gas sampling, in-business air sampling, and SVE testing activities conducted at the WDI site to characterize current soil gas conditions, assess the extent and potential for soil gas migration, and to establish a technical basis for the final site remedial design. Specific objectives of this evaluation include the following:

- Identify historical and current patterns and trends in subsurface gas composition, specifically defining areas of high concentrations of soil gas chemicals of concern (COCs);
- Compare and evaluate the soil gas sampling results relative to the interim threshold screening levels initially established by the USEPA for the WDI site to identify areas of concern and potential migration of soil gas COCs;
- Evaluate and compare the results of the in-business air sampling with subsurface soil gas conditions to assess potential migration and risk exposure to occupants in on-site business; and
- Summarize the results of SVE testing conducted by the Waste Disposal, Inc. Group (WDIG) at the site to evaluate the feasibility of this technology in controlling subsurface gas migration and reducing potential hazards associated with soil gas COCs.

1.2 REPORT ORGANIZATION

This report summarizes the subsurface gas investigations and results of soil gas sampling and monitoring activities conducted at the WDI site from 1989 through July 1998. This report also summarizes the results of in-business air monitoring and SVE testing conducted in 1997-1998 as part of the RD activities for the WDI site. This report is intended to be an overall summary and evaluation of the completed soil gas investigations, in-business air sampling, and SVE testing to provide a current technical assessment and basis for completing the RD activities. The reader is referred to the original source documents and reports for additional background, specific objectives, supportive data, and descriptions of the soil gas, in-business air quality, and SVE investigations addressed in this report.

This report is organized as a general summary and data evaluation and includes the following sections:

- Section 2 presents background information and the site conceptual model which pertains to soil gas conditions at the WDI site.
- Section 3 summarizes the soil gas investigation/monitoring activities, in-business air sampling, and SVE testing that have been conducted at the site through November 1998.
- Section 4 provides background information on the soil gas interim threshold screening levels previously defined for the WDI site, and presents the results of an updated assessment of soil gas COCs and development of provisional performance standards.
- Section 5 describes the approach, analytical data, and results of an evaluation of soil gas conditions based on the recent 1998 sampling and analyses of the current network of vapor monitoring wells.
- Section 6 summarizes the results of the in-business air sampling of buildings and businesses at the site and evaluates the findings in the context of the soil gas conditions presented in Section 5.
- Section 7 provides a summary of the SVE testing conducted by the WDIG and an assessment of the feasibility of SVE as a remedial alternative.

Section 2.0

2.0 BACKGROUND

2.1 SITE LOCATION

The WDI Superfund Site is located in the city of Santa Fe Springs, Los Angeles County, California, on a 43-acre parcel of land (Figure 2-1). The site is bordered on the northwest by Santa Fe Springs Road, on the northeast by the Fedco Food Distribution Center and St. Paul High School, on the southwest by Los Nietos Road, and on the southeast by Greenleaf Avenue. A residential area is located east of the site, on the east side of Greenleaf Avenue. The remaining areas on, and across from, Greenleaf Avenue, Los Nietos Road, and Santa Fe Springs Road are occupied by a variety of industrial businesses (Figure 2-1).

The surface elevation of the WDI site is approximately 160 feet above mean sea level. The main portion of the site, representing the fill material that has been placed over the former oil-storage reservoir, is situated from 10 to 20 feet above the elevation of the surrounding area.

2.2 SITE HISTORY

The WDI site contains a 42 million-gallon capacity concrete-lined reservoir originally constructed at grade for crude petroleum storage. The reservoir was decommissioned in the mid 1930s for product storage, but was subsequently used for disposal of a variety of oil field and industrial wastes, and construction debris. Aerial photographs taken during the 1920s, 1930s, 1940s, and 1950s show that the reservoir and surrounding areas were used for the disposal of a variety of hazardous substances including both liquid and solid wastes. Wastes disposed of at the site include petroleum-related chemicals, solvents, drilling muds, sludges, construction debris, and other industrial waste materials. Disposal activities continued unregulated until 1949, and thereafter under a permit from Los Angeles County until the m-d-1960s, when grading at the site was completed. Between 5 and 15 feet of fill material was brought in and the grade of the site was raised to 5 feet above the upper lip of the concrete reservoir and 15 feet above the original grade of the land.

Since 1966, when grading of the reservoir area was completed, the site was subdivided into 22 parcels. Structures have since been built on all but four of the parcels: the reservoir area (Parcels 25 and 26), and the eastern-most properties (Parcels 49 and 51). During the 1970s, ten additional structures were built that were subsequently removed during the 1980s. Presently, there are 23 structures on the site. The majority of the reservoir area is an open field; the northern corner of the reservoir area is covered by an asphalt paved storage yard used for recreational vehicles.

2.3 PROJECT BACKGROUND

In 1987, the USEPA placed the WDI site on the National Priorities List (NPL). During 1988-1989, USEPA conducted a remedial investigation (RI) of the site, during which more than 100 soil borings were drilled and sampled, and 26 vapor monitoring wells and 27 groundwater monitoring wells were installed. USEPA divided the site into two Operable Units (OUs) with the first OU addressing on-site waste, contaminated soils, and subsurface gas. The feasibility study for this OU was completed in 1993 and the Record of Decision (ROD) issued in December 1993 *(Waste Disposal, Inc. Soil and Subsurface Gas Operable Unit Record of Decision,* USEPA, 1993b). The ROD for the groundwater OU was delayed pending USEPA's collection of additional groundwater quality data. During the period of 1995 to the present, subsequent to the 1993 ROD, additional information for all site media (soil gas, waste/soil, liquids/groundwater) has been obtained to assist in the remedial design and to support potential revisions to the remedy.

Figure 2-2 is a map of the WDI site showing the primary surface features and the eight site areas defined in the 1993 ROD. In response to USEPA's original Administrative Order, Docket No. 94-17, issued on December 27, 1993, the Waste Disposal, Inc. Group (WDIG) initiated predesign field activities during 1995 which focused primarily on investigating soil conditions in site Areas 4 and 7 (Figure 2-2), and confirming prior soil gas and groundwater investigations.

Beginning in late 1997 until the present, the WDIG has undertaken additional RD investigative activities in accordance with USEPA's 1997 Amended Administrative Order (Docket 97-09). The amended Order required quarterly soil gas and groundwater monitoring in addition to investigation of the source of elevated levels of volatile organic compounds in the soil gas detected in the subsurface soils adjacent to on-site buildings. USEPA's analysis of the results of the soil vapor extraction (SVE) testing conducted by the WDIG is summarized in this report. The specific data findings for the SVE testing and other WDIG investigative activities are summarized in separate WDIG reports.

2.4 SITE CONCEPTUAL MODEL

Based on the site investigations and characterization studies completed to date, the site conceptual model developed during the initial RI (Ebasco, 1989a) has been updated for this subsurface gas evaluation report. The WDI site conceptual model is shown in Figure 2-3 and illustrates the following site features and conditions relevant to soil gas evaluation:

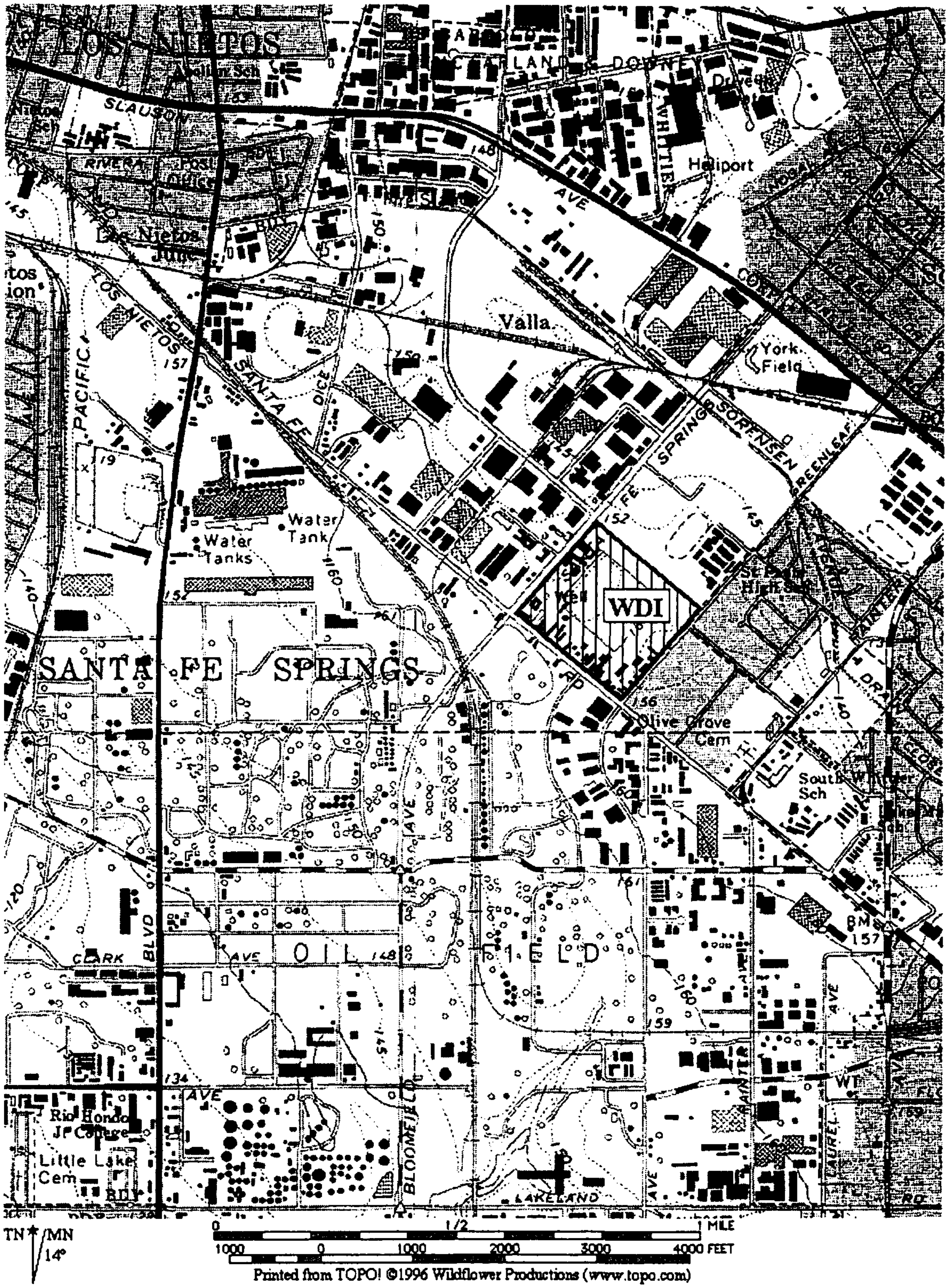
- Based on recent monitoring, the depth to groundwater at the site ranges from approximately 30 to 48 feet below ground surface (bgs) (the thickness of the unsaturated or vadose zone). The upper water-bearing zone, consisting of alluvial/fluvial deposits, appears to comprise a continuous and interconnected sandy aquifer interbedded with minor amounts of clay and silt. The deepest soil borings (100 to 130 feet bgs) drilled at the WDI site to date have not identified laterally extensive confining beds (aquitards) within the upper water-bearing zone. The base of the upper water-bearing zone underlying WDI is not known but may extend to depths of 150 to 200 feet bgs based on regional data.

- The primary contaminant sources at the WDI site include: (1) solid and liquid wastes within the buried concrete-lined earthen reservoir; and (2) similar types of buried waste (primarily drilling muds containing hazardous substances) and contaminated soils that were disposed outside of the reservoir in unlined sumps or other types of disposal areas throughout the central area of the 40 acre site extending into, and underneath, on-site buildings along the perimeter of the site. The interval of buried waste and impacted soils ranges in depth from approximately 5 feet to a maximum of 27 feet bgs. Currently, the top of the saturated zone (water table) is approximately 20 to 30 feet below the estimated base elevations of the buried waste and concrete reservoir, respectively (Figure 2-3).

- Subsurface investigations and vapor well sampling confirm that elevated concentrations of methane and other soil gas COCs occur within the buried reservoir and at shallow to deep (5 to 35 feet bgs) intervals of the vadose zone outside of the buried reservoir. The areas of elevated concentrations of soil gas COCs are located within the reservoir and in approximately five disposal areas outside of the reservoir of which several are adjacent to, or underneath, on-site buildings (see Figure ES-1).

- Currently, the WDI site is subdivided into 22 parcels and there are 23 buildings and structures used primarily for industrial and commercial uses. The nearest residences are located approximately 300 feet east of the boundary of the WDI site (Figure 2-1).

The general subsurface gas conditions at the WDI site are is illustrated in Figure 2-4. This schematic section shows the typical monitoring/sampling intervals for the single-screen and multi-level vapor monitoring wells installed at the site, the general depth and thickness of the buried waste zone, and the representative concentrations of methane, oxygen, and carbon dioxide measured in subsurface gas.



Source: USGS, Whittier Quadrangle
7.5' Series Topographic

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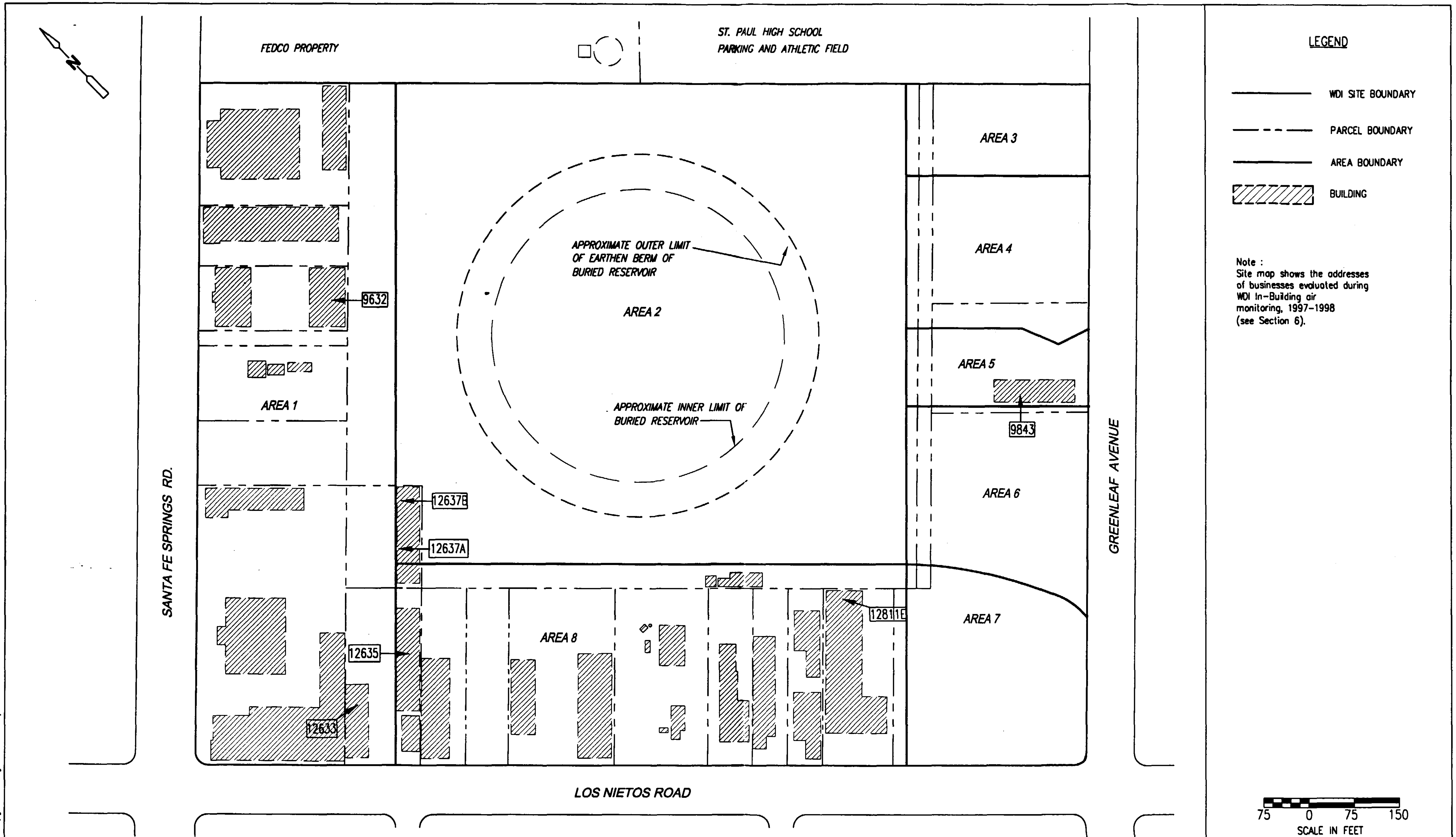
Location of WDI Site
Santa Fe Springs, California

Figure 2-1



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WDI SITE FEATURES
WASTE DISPOSAL, INC.
SANTA FE SPRINGS, CALIFORNIA

Figure 2-2

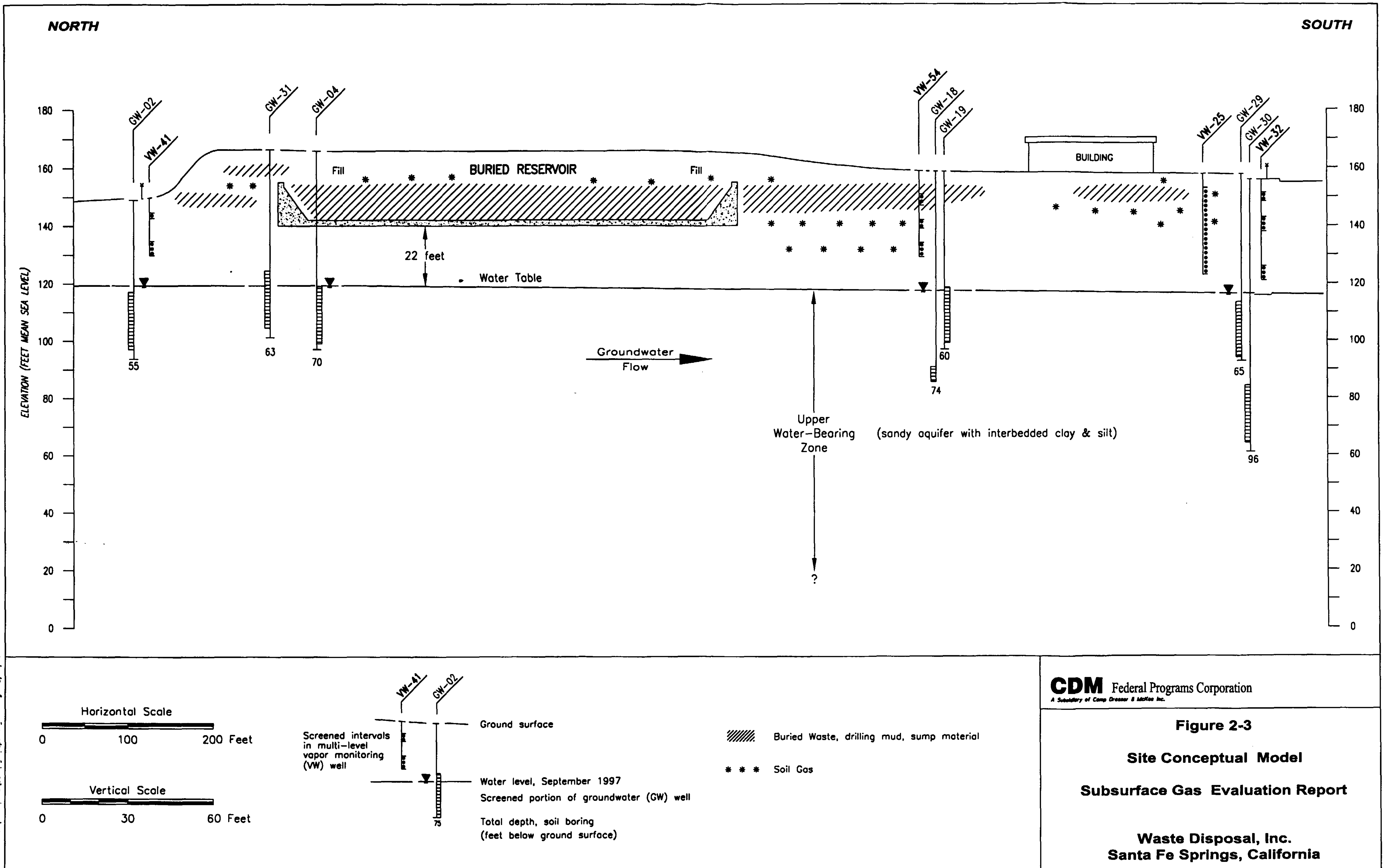

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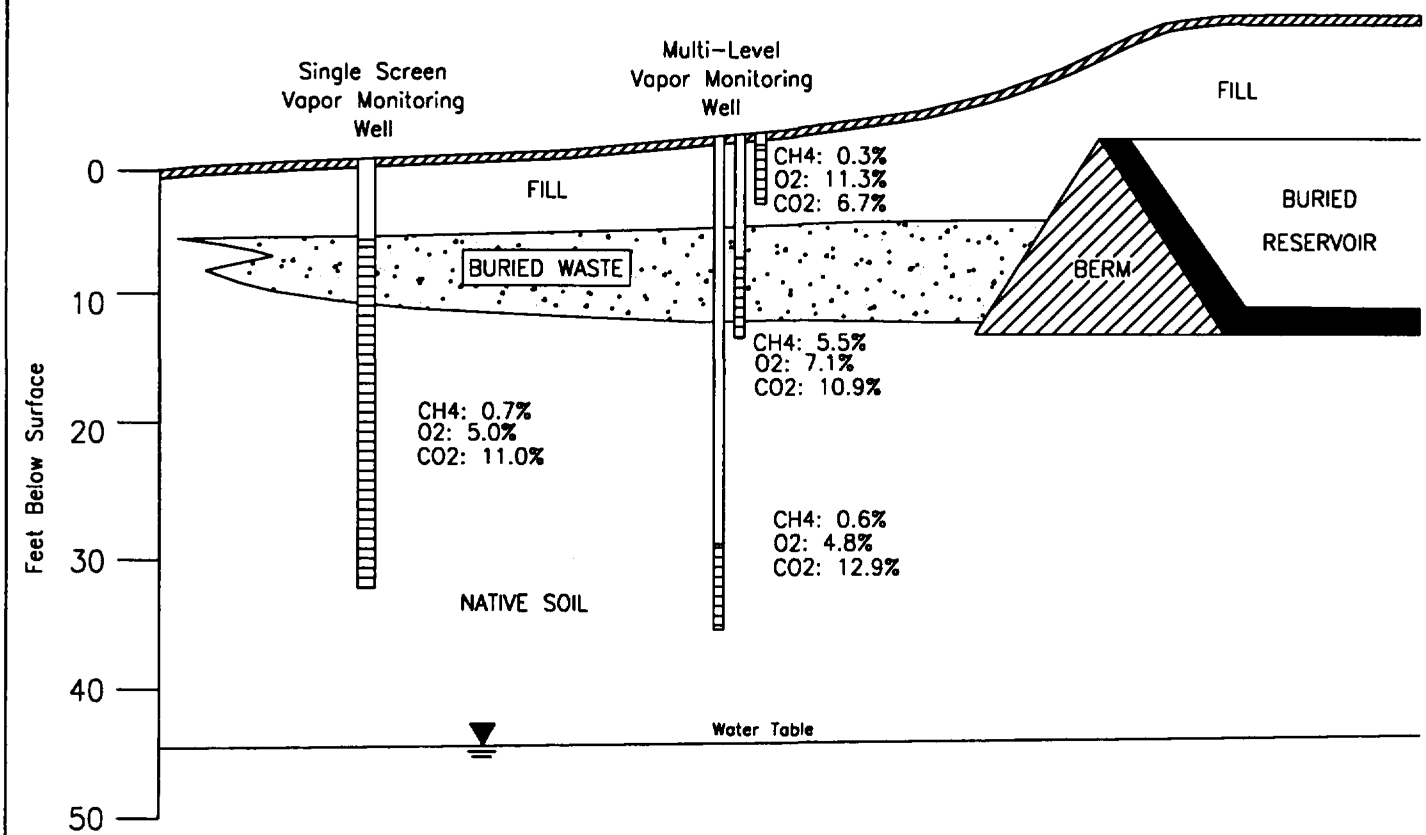
Figure 2-3

Site Conceptual Model

Subsurface Gas Evaluation Report

Waste Disposal, Inc.
Santa Fe Springs, California



Average concentrations of methane (CH_4), oxygen (O_2), & carbon dioxide (CO_2); stabilized parameters after purging

8/17/99 Fig 2-4new c:\cadd\6118\006\sg2\rept

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Subsurface Gas Conditions, Schematic Section
Waste Disposal Inc. Site
Santa Fe Springs, California

Figure 2-4

Section 3.0

3.0 SUMMARY OF SUBSURFACE GAS AND IN-BUSINESS AIR INVESTIGATIONS

Beginning with USEPA's Remedial Investigation in 1988-1989, soil gas and in-business air investigations, sampling, and monitoring have been conducted at the WDI site to characterize subsurface gas conditions and to assess the nature, extent, and potential hazards associated with site wastes and contamination. This section summarizes the soil gas investigation, sampling, and monitoring activities conducted through November 1998. For background, this section additionally summarizes the results of USEPA's initial soil gas sampling (1988-1989 RI) and confirmation soil gas sampling conducted by WDIG in 1995. The results, findings, and evaluation of the more recent 1997-1998 soil gas investigation, monitoring, and SVE testing activities are presented and evaluated in Sections 5, 6, and 7, respectively.

3.1 SUBSURFACE GAS INVESTIGATIONS

1988-89 USEPA Remedial Investigation

During the RI in 1988-89, a total of 26 single-screen vapor monitoring wells were installed at the WDI site to investigate subsurface gas conditions (Ebasco, 1988b). The location of the RI vapor wells are shown on Figure 3-1. Monitoring well construction data and current well conditions for the vapor wells VW-01 through VW-26 are summarized in Table 3-1. The first sampling of the RI vapor monitoring wells was conducted in March 1989 and the soil gas samples were analyzed for volatile organic compounds (VOCs) using a full scan GC/MS and results were reported for the following ten target compounds: vinyl chloride; dichloromethane; chloroform; 1,1,1-trichloroethane (TCA); 1,2-dichloroethane (DCA); benzene; carbon tetrachloride; trichloroethene (TCE); 1,2-dibromoethane; and tetrachloroethene (PCE). With the exception of dichloromethane, all of the target compounds were detected during the initial sampling. The highest VOC concentrations were detected in VW-09 (reservoir well) with 16,000 parts per billion by volume (ppbv) benzene and 12,000 ppbv vinyl chloride. TCE and PCE were also detected in the soil gas samples collected from VW-09 and most of the other vapor wells (maximum TCE detected 3,000 ppbv, well VW-22).

The soil gas samples were also analyzed for hydrogen, nitrogen, oxygen, methane, carbon monoxide, and carbon dioxide. Concentrations ranged from 16.1 to 81.6% for nitrogen, 1.53 to 18.24% for oxygen, 0.0 to 0.02% for carbon monoxide, 0.1 to 17.6% for carbon dioxide, and 0.0 to 39.1% for methane. The highest methane concentration (39.1%) was measured in VW-09.

1995 WDIG Confirmation Soil Gas Sampling

In June 1995, as part of predesign remedial investigations, the WDIG sampled 23 of the vapor wells for methane analysis using South Coast Air Quality Management District (SCAQMD) Modified Method 25.1 and six selected vapor wells for VOCs using USEPA Method TO-14. The vapor wells sampled for VOCs included VW-02, VW-04, VW-07, VW-14, VW-18, and VW-25. The TO-14 analysis reported the results for 22 target compounds. Overall, the 1995 VOC analyses confirmed the presence of vinyl chloride, benzene, TCE, and PCE in the same wells where these compounds were detected in 1989. However, the soil gas results for the 1989 and 1995 sampling events showed inconsistencies between the two data sets. In some cases higher methane and VOC concentrations were detected in the 1995 samples. For example, methane at VW-25 measured 18.5% in 1995 while only 0.29% in 1989. Benzene was detected at VW-18 at a concentration of 2,000 ppbv in 1995 while benzene was not detected above a reporting limit of 20 ppbv in the 1989 sampling at this well. Additionally, other VOCs (which were not reported as target compounds in 1989) were detected in some of the 1995 soil gas samples, primarily ethylbenzene, toluene, and xylenes.

1997 USEPA Subsurface Gas Investigation

During July-August 1997, the USEPA implemented a soil gas investigation and expanded sampling of the RI vapor monitoring wells to provide a more comprehensive characterization of the soil gas conditions at the WDI site. The 1997 subsurface gas investigation was performed by CDM Federal according to the *Subsurface Gas Contingency Plan (SGCP)* (CDM Federal, 1997) and consisted of soil gas sampling from 186 temporary soil probes installed throughout the site and multiple sampling from the existing vapor monitoring wells. The results and a summary of the SGCP investigation are presented in the *Subsurface Gas Contingency Plan Investigation Report* (CDM Federal, 1999a).

During the SGCP investigation, soil gas samples were collected from 23 of the 26 RI vapor wells and two dual-probe vapor monitoring wells (MP-01 and MP-02) installed in 1996 (see Figure 3-1 and Table 3-1). The samples were collected during two separate sampling rounds (July and August 1997) in 1-liter Tedlar bags for on-site analysis by the USEPA Region 9 Field Analytical Support Program (FASP) laboratory or in 6-liter SUMMA canisters for off-site laboratory analysis by Quanterra Environmental Services. The FASP laboratory analyzed soil gas for VOCs using gas chromatography/mass spectrometry (GC/MS) and following protocols outlined in the USEPA Contract Laboratory Program Statement of Work for Organics Analysis (OLMO3.1) and the USEPA SW846 8260 Method. Quanterra analyzed samples for VOCs using USEPA Method TO-15 and for methane using SCAQMD Method 25.1. Field instruments were also used during sampling to measure methane, oxygen, carbon dioxide, and total VOCs concentrations in the vapor well gas samples.

The SGCP soil gas investigation involved installation and sampling of temporary soil probes (direct-push) to depths ranging up to 20 ft bgs at 186 locations throughout the WDI site (Figure 3-2). Soil gas samples were collected from the probes in 1-liter Tedlar bags for field screening analysis (OnSite Environmental) using a modified USEPA 8021 Method. The FASP laboratory confirmed the results of the screening laboratory at key locations which exhibited elevated VOC concentrations or samples containing compounds not identified by the screening laboratory. The screening laboratory and the FASP laboratory analyzed 150 samples collected from 10 feet bgs, 21 samples from 20 feet bgs, 21 samples from less than 10 feet bgs, and one sample from 15 feet bgs (CDM Federal, 1999a). Field instruments were also used during sampling to measure methane, oxygen, carbon dioxide, and total VOCs concentrations in the temporary probe gas samples.

1997-98 WDIG Vapor Monitoring Well Installation

The WDIG installed 27 additional vapor monitoring wells in 1998 as part of their RD Investigative Activities (TRC, 1997a). Figure 3-1 shows the locations of the new multi-level monitoring wells, (designated VW-27 through VW-53) and Table 3-1 lists well construction data for these wells. To monitor for potential subsurface migration of soil gas off site, 16 of the vapor wells were installed along the perimeter of the WDI site (Figure 3-1). The WDIG also installed 11 interior monitoring wells near site buildings and between the reservoir and site buildings. The WDIG used the results of the SGCP Investigation Report (CDM Federal, 1999a) to install the interior wells in areas of elevated methane and

VOCs. Based on the lithology encountered during drilling, the WDIG installed either two or three separate soil gas monitoring probes at each vapor well. The objectives of the screened zones at each well were to: (1) monitor shallow soils typically found above buried waste (sump materials); (2) monitor buried waste materials or the equivalent depth interval of the nearest buried wastes; and (3) monitor a depth interval below the zone of buried waste. The new vapor wells were incorporated in the WDIG's *Comprehensive Subsurface Gas Quarterly Monitoring Plan* (TRC, 1997b) and quarterly sampling program as described below.

1998 USEPA Vapor Monitoring Well Installation

To further monitor subsurface gas conditions in the immediate vicinity of the on-site buildings, CDM Federal, on behalf of the USEPA, installed ten additional vapor monitoring wells at the site during July 1998. The locations of these wells (designated VW-54 through VW-63) are shown on Figure 3-1 and Table 3-1 lists well construction data for these wells. The USEPA vapor monitoring wells were installed in accordance with the WDIG methodology described above and each well contains three soil gas probes screened at shallow, intermediate, and deep intervals. The new vapor wells were first sampled for VOCs (USEPA Method TO-15) and methane (SCAQMD Method 25.1) in July 1998. The boring/well logs, sampling records, and validated laboratory results are included in an Addendum to the SGCP Investigation Report (CDM Federal, 1999b). Subsequent to USEPA's initial sampling, the new vapor wells were incorporated in the WDIG's quarterly soil gas monitoring program.

WDIG Quarterly Soil Gas Monitoring Program

Beginning in February 1998, the WDIG have conducted quarterly sampling of all WDI vapor monitoring wells in accordance with their *Comprehensive Subsurface Gas Quarterly Monitoring Plan* (TRC, 1997b). The WDIG's soil gas monitoring program follows the field procedures described in the Revised Field Sampling Plan and the Revised Quality Assurance Project Plan (*RD Investigative Activities Workplan*, TRC, 1997a). The soil gas samples are collected from the vapor wells in 6-liter SUMMA canisters and submitted to an off-site laboratory for VOC analysis (USEPA Method TO-14) and methane and non-methane hydrocarbons (SCAQMD Method 25.1). Field instruments are also used during WDIG's sampling to measure methane, oxygen, and carbon dioxide concentrations in the vapor well gas samples. In addition, on behalf of the USEPA, split soil gas samples were collected by CDM Federal during

WDIG's monitoring events during February, April, and October 1998 and submitted for off-site analyses using an independent laboratory (Quanterra Inc.).

A summary of the soil gas monitoring program and the results of the WDIG's 1998 quarterly sampling events (February, April, July, October 1998) are presented in the *1998 Annual Soil Gas Monitoring Report* (TRC, 1999a). This report also includes the WDIG's preliminary evaluation of the 1998 soil gas data and recommendations for modifying the quarterly monitoring program.

3.2 IN-BUSINESS AIR SAMPLING

USEPA 1997 Sampling

In combination with the 1997 SGCP investigation, the USEPA implemented a comprehensive in-business air sampling program at the WDI site (CDM Federal, 1997). During this investigation, 44 in-business air samples were collected from portions of every building at the WDI site, but not from all of the 55 tenant spaces in the 25 buildings present at the site. As a "worst case" analysis of the in-business air quality of the on-site buildings, 24-hour integrated air samples were collected over the weekend when the businesses were more likely to be closed, and there was less ventilation with outside air. The in-business air samples were collected in 6-liter SUMMA canisters and submitted for VOC analysis (USEPA Method TO-15) using either the USEPA Region 9 laboratory or the Quanterra Inc. laboratory. At nine businesses, samples were also analyzed for methane and total non-methane hydrocarbons by SCAQMD Method 25.1. The results, discussion, and evaluation of the in-business sampling event are presented in the SGCP Investigation Report (CDM Federal, 1999a). A complete list of the buildings sampled during the 1997 in-business air sampling event is provided in Table 3-2.

WDIG 1998 In-Business Air Monitoring

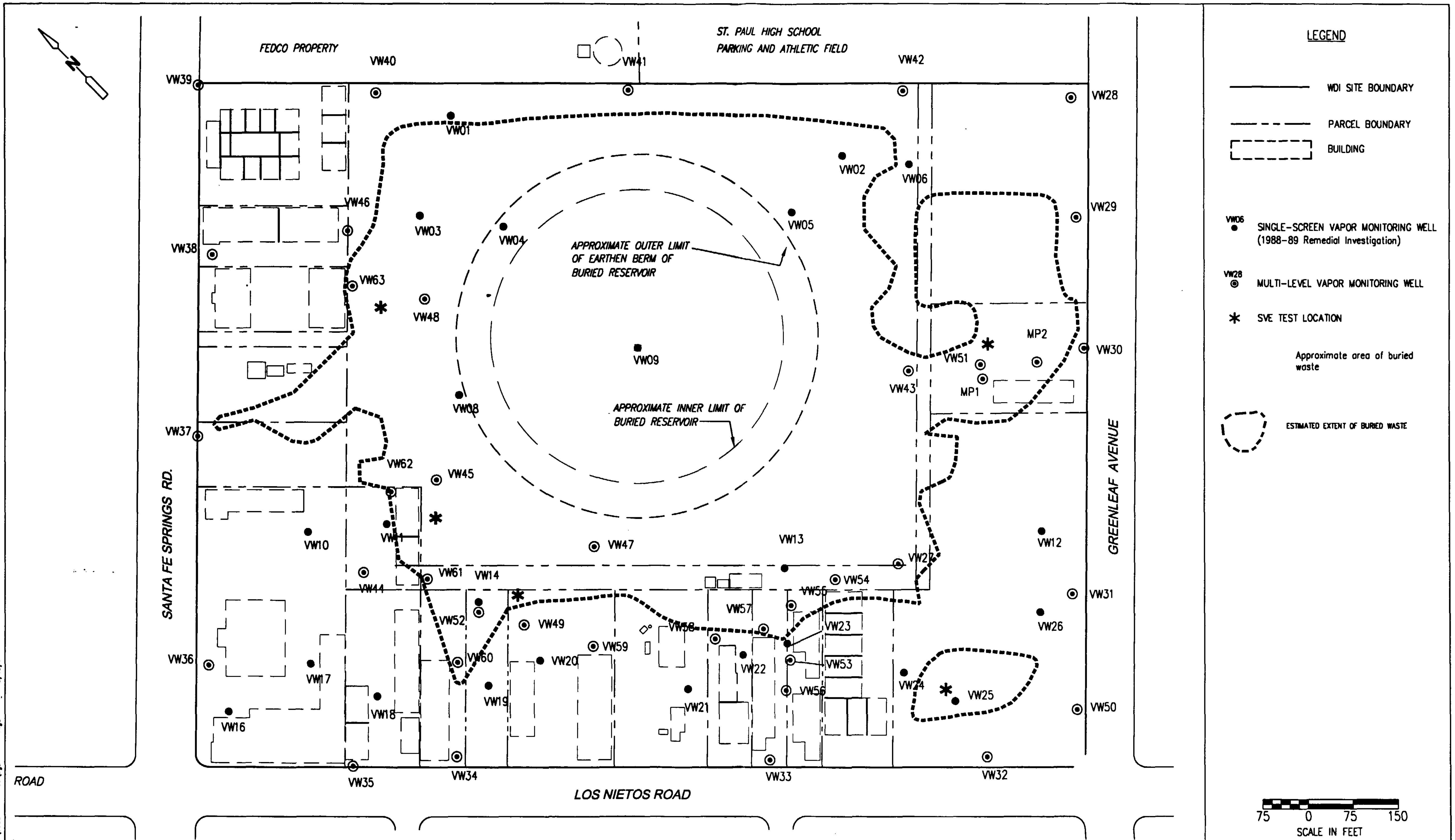
Based on the results of previous in-business air sampling and soil gas investigations, the USEPA directed the WDIG to perform additional air monitoring within businesses located in buildings adjacent to buried wastes and, in particular, near areas where elevated concentrations of VOCs and methane were confirmed in soil gas. The objective of the in-business air monitoring was to determine whether contaminants in soil gas were infiltrating into on-site buildings (TRC, 1999b). The following seven businesses have been sampled as part of the in-business air monitoring performed by the WDIG in 1998 (see Figure 2-2 for locations):

- 9843 Greenleaf Avenue
- 9632 Santa Fe Springs Road
- 12633 Los Nietos Road
- 12635 Los Nietos Road
- 12637A Los Nietos Road
- 12637B Los Nietos Road
- 12811E Los Nietos Road

The WDIG adopted the Field Sampling and Analysis Plan (FSAP) and the Quality Assurance Project Plan (QAPP) for the SGCP for its In-Business Air Sampling FSAP and QAPP (TRC, 1997a). An off-site laboratory analyzed the WDIG samples for VOCs by USEPA Method TO-14 and for methane and total non-methane hydrocarbons by SCAQMD Method 25.1. Sampling information for the WDIG's in-business air monitoring is provided in Table 3-2.

3.3 SOIL VAPOR EXTRACTION TESTING

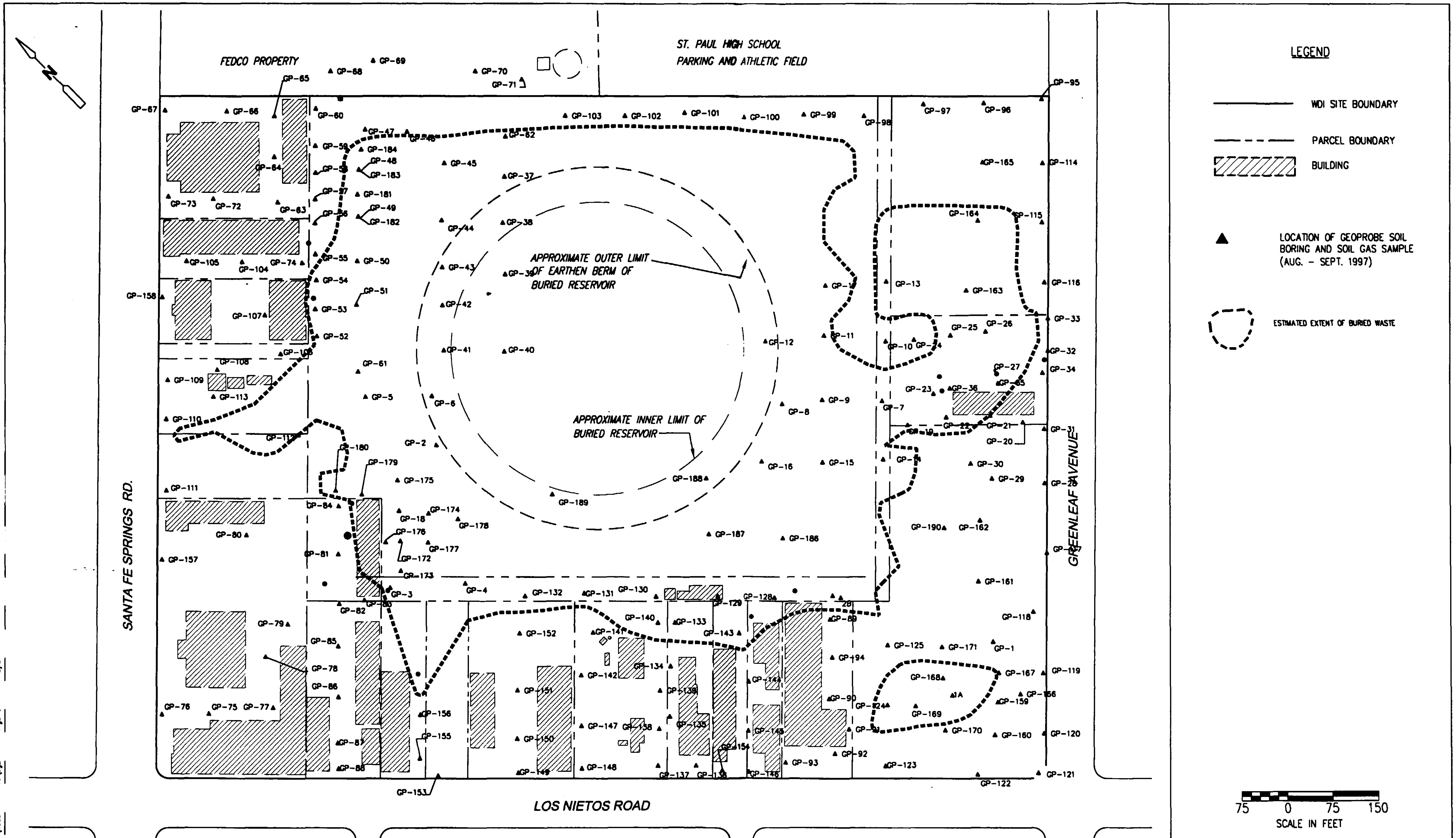
During the period June 1998 through January 1999, the WDIG performed soil vapor extraction (SVE) testing at selected locations at the WDI site that have previously shown elevated methane and VOC soil gas concentrations. The SVE testing was performed in accordance with the WDIG's *Technical Memorandum No. 9A - Soil Vapor Extraction Testing* (Rev 2.0) (TRC, 1998b). New test wells were installed and SVE tests performed in the following five site areas: Area 5, Area 7, Area 8, southwestern part of Area 2, and the western part of Area 2 (RV storage lot). The primary objective of the testing program was to assess the feasibility of SVE technology in controlling soil gas generation and preventing subsurface migration in various locations of the WDI site. The testing was conducted in two phases; Phase I consisted of active SVE treatment at each of the five areas and Phase II consisted of gas recovery monitoring immediately following the Phase I activities. The results of the WDIG's SVE testing program were reported in *Technical Memorandum No. 9A - Soil Vapor Extraction Testing Report of Findings* (TRC, 1999c) and a summary of the SVE study is presented in Section 7 of this report.



CDM Federal Programs Corporation
A Subsidiary of Camp Dresser & McKee Inc.

EXISTING SOIL GAS MONITORING WELLS
WASTE DISPOSAL INC.
SANTA FE SPRINGS, CALIFORNIA

Figure 3-1



CDM Federal Programs Corporation
A Subsidiary of Camp Dresser & McKee Inc.

TEMPORARY SOIL GAS SAMPLING LOCATIONS
WASTE DISPOSAL, INC.
SANTA FE SPRINGS, CALIFORNIA

Figure 3-2

Table 3-1: Vapor Monitoring Well Identification and Construction Summary
Waste Disposal, Inc. Site

Well / Probe Identification	Monitoring Interval (feet bgs)	Formation / Material	Site Location	Remarks
SINGLE-SCREEN MONITORING WELLS				
VW-01-035	5 - 35	fill & native	Area 2	
VW-02-035	5 - 35	fill, waste & native	Area 2 (east sump area)	
VW-03-035	5 - 35	fill, waste & native	Area 2 (west sump area)	
VW-04-023	6 - 23	fill, waste & native	Area 2 (Reservoir berm)	
VW-05-029	4 - 29	fill / berm?	Area 2 (Reservoir berm)	
VW-06-034	4 - 34	fill / berm?	Area 3	
VW-07-035	5 - 35	fill & native	Area 5	well could not be located (8/97)
VW-08-035	5 - 35	fill / berm?	Area 2	
VW-09-023	5 - 23	waste	Area 1 (within Reservoir)	
VW-10-035	5 - 35	fill & native	Area 1	
VW-11-035	5 - 35	fill & native (stained)	Area 1 (C&E Die)	
VW-12-034	4 - 34	fill & native	Area 6	
VW-13-031	6 - 31	waste & native	Area 2 (south sump area)	
VW-14-035	5.5 - 35.5	waste & native	Area 8	
VW-15-035	5 - 35	fill & native	Area 2	well casing damaged (8/97)
VW-16-034	4 - 34	native	Area 1 (Dialog)	
VW-17-035	5 - 35	native	Area 1 (Dialog)	
VW-18-036	6 - 36	native	Area 1	
VW-19-036	6 - 36	native	Area 8	well could not be located (8/97)
VW-20-035	5.5 - 35.5	native	Area 8	
VW-21-036	6 - 36	native	Area 8	
VW-22-035	5 - 35	native	Area 8	
VW-23-036	6 - 36	native	Area 8	
VW-24-035	5 - 35	native	Area 7	
VW-25-035	5 - 35	native & waste	Area 7	
VW-26-035	5 - 35	native	Area 7	
MULTI-LEVEL MONITORING WELLS				
VW-27-009	6 - 9	native	Area 8	
VW-27-019	16 - 19	native		
VW-27-033	28 - 33	native		
VW-28-010	5 - 10	native	Area 3 (site perimeter, St. Paul HS)	
VW-28-025	20 - 25	native		
VW-29-010	7 - 10	native	Area 4 (site perimeter)	
VW-29-023	18 - 23	native		
VW-29-035	30 - 35	native		
VW-30-007	5 - 7	fill	Area 5 (site perimeter)	
VW-30-023	18 - 23	naïve		
VW-30-035	30 - 35	native		
VW 31-010	5 - 10	native	Area 6 (site perimeter)	
VW 31-030	25 - 30	native		

Table 3-1: Vapor Monitoring Well Identification and Construction Summary
Waste Disposal, Inc. Site

Well / Probe Identification	Monitoring Interval (feet bgs)	Formation / Material	Site Location	Remarks
VW-32-007	4.5 - 7.5	fill & native	Area 7 (site perimeter)	
VW-32-018	13 - 18	native		
VW-32-035	30 - 35	native		
VW-33-010	5 - 10	native	Area 8 (site perimeter)	
VW-33-035	30 - 35	native		
VW-34-010	5 - 10	native	Area 8 (site perimeter)	
VW-34-023	18 - 23	native		
VW-34-040	35 - 40	native		
VW-35-010	5 - 10	fill & native	Area 1 (site perimeter)	
VW-35-038	33 - 38	native		
VW-36-010	5 - 10	native	Area 1 (site perimeter)	
VW-36-030	25 - 30	native		
VW-37-010	7 - 10	native	Area 1 (site perimeter)	
VW-37-030	25 - 30	native		
VW-38-010	5 - 10	native	Area 1 (site perimeter)	
VW-38-034	29 - 34	native		
VW-39-007	5 - 7	native	Area 1 (site perimeter, FEDCO)	
VW-39-030	25 - 30	native		
VW-40-010	5 - 10	native	Area 1 (site perimeter, FEDCO)	
VW-40-025	20 - 25	native		
VW-41-007	5 - 7	fill	Area 1 (site perimeter, FEDCO)	
VW-41-020	15 - 20	native		
VW-42-010	5 - 10	fill	Area 2 (site perimeter, St. Paul HS)	
VW-42-030	25 - 30	native		
VW-43-010	5 - 10	fill	Area 2 (east sump area)	
VW-43-019	16 - 19	berm?		
VW-43-032	27 - 32	native		
VW-44-007	5 - 7	fill	Area 1	
VW-44-016	13 - 16	native		
VW-44-030	25 - 30	native		
VW-45-012	7.5 - 12.5	waste	Area 2 (west sump area)	
VW-45-021	18.5 - 21.5	waste		
VW-45-030	27 - 30	native		
VW-46-006	4.5 - 6.5	native	Area 1	
VW-46-015	12 - 15	native		
VW-46-027	22 - 27	native		
VW-47-007	4.5 - 7.5	fill	Area 2 (south sump area)	
VW-47-018	13 - 18	native		
VW-47-030	26 - 30	native		
VW-48-008	5 - 8	waste	Area 2 (west sump area)	
VW-48-017	12 - 17	waste		
VW-48-035	30 - 35	native		
VW-49-010	5 - 10	native	Area 8	
VW-49-018	15 - 18	native		
VW-49-030	25 - 30	native		
VW-50-008	5 - 8	native	Area 7 (site perimeter)	
VW-50-018	13 - 18	native		
VW-50-035	30 - 35	native		

Table 3-1: Vapor Monitoring Well Identification and Construction Summary
Waste Disposal, Inc. Site

Well / Probe Identification	Monitoring Interval (feet bgs)	Formation / Material	Site Location	Remarks
VW-51-008	5 - 8	waste	Area 5 (Brothers Machine Shop)	
VW-51-018	13 - 18	waste		
VW-51-030	25 - 30	native		
VW-52-010	7 - 10	native	Area 8	
VW-52-019	14 - 19	native		
VW-52-030	25 - 30	native		
VW-53-010	7 - 10	native	Area 8	
VW-53-020	15 - 20	native		
VW-53-030	25 - 30	native		
VW-54-012	8 - 12	fill & waste	Area 8 (H&H Contractors)	
VW-54-020	17 - 20	native		
VW-54-030	25 - 30	native		
VW-55-010	5 - 10	waste	Area 8 (H&H Contractors)	
VW-55-020	17 - 20	native		
VW-55-030	25 - 30	native		
VW-56-010	5 - 10	native	Area 8	
VW-56-020	17 - 20	native		
VW-56-030	25 - 30	native		
VW-57-010	5 - 10	fill	Area 8	
VW-57-020	17 - 20	native		
VW-57-030	25 - 30	native		
VW-58-008	5 - 8	native	Area 8	
VW-58-019	14 - 19	native		
VW-58-030	25 - 30	native		
VW-59-008	5 - 8	native	Area 8	
VW-59-018	15 - 18	native		
VW-59-030	25 - 30	native		
VW-60-008	5 - 8	native	Area 8	
VW-60-019	14 - 19	native		
VW-60-030	25 - 30	native		
VW-61-008	5 - 8	fill	Area 2 (C&E Die)	
VW-61-019	14 - 19	waste & native		
VW-61-030	25 - 30	native		
VW-62-010	5 - 10	native	Area 1 (C&E Die)	
VW-62-018	15 - 18	native		
VW-62-030	25 - 30	native		
VW-63-008	5 - 8	waste	Area 1 (RV Storage Lot)	
VW-63-018	13.5 - 18.5	native		
VW-63-030	25 - 30	native		
MP-01-005	3 - 5	fill	Area 5 (Brothers Machine Shop)	Probes installed 1996
MP-01-015	10 - 15	waste		
MP-02-005	3 - 5	fill	Area 5 (Brothers Machine Shop)	Probes installed 1996
MP-02-015	10 - 15	waste		

TABLE 3-2
SUMMARY OF IN-BUSINESS AIR SAMPLING
AUGUST 1997 THROUGH NOVEMBER 1998, USEPA and WDIG SAMPLING EVENTS

Sample Location Address/Business	Sample Date	Sampler	Sample ID	Laboratory	Analysis	Comment
9843 Greenleaf Ave.	8/4/97	USEPA	SYN538	USEPA Region 9 lab	VOCs	Split Sample
Brothers Machine Shop	8/4/97	USEPA	SYN471	Quanterra	VOCs	
	8/25/97	USEPA	SYN497	Quanterra	VOCs, Methane, TNMOC	
	8/25/97	USEPA	SYN498	Quanterra	VOCs, Methane, TNMOC	Field Duplicate
	2/9/98	WDIG	WDI-IBM50-1	Performance Analytical	VOCs, Methane, TNMOC	
	2/9/98	WDIG	WDI-IBMFD50-1	Performance Analytical	VOCs, Methane, TNMOC	Field Duplicate
	2/9/98	USEPA	9843 Greenleaf	Quanterra	VOCs, Methane, TNMOC	Split Sample
	3/9/98	WDIG	WDI-IBM50-02	Performance Analytical	VOCs, Methane, TNMOC	
	4/6/98	WDIG	WDI-IBM50-03	Performance Analytical	VOCs, Methane, TNMOC	
	5/3/98	USEPA	9843	Quanterra	VOCs, Methane, TNMOC	Split Sample
	5/3/98	WDIG	WDI-IBM50-04	Performance Analytical	VOCs, Methane, TNMOC	
	7/1/98	WDIG	WDI-IBM50-05	Performance Analytical	VOCs, Methane, TNMOC	
	11/9/98	WDIG	WDI-IBM50-06	Performance Analytical	VOCs, Methane, TNMOC	
12631 Los Nietos Rd	8/11/97	USEPA	SYN544	USEPA Region 9 lab	VOCs	
Metro Diesel						
12633 Los Nietos Rd.	8/25/97	USEPA	SYN517	USEPA Region 9 lab	VOCs	
R & R Sprouts	5/3/98	WDIG	WDI-IBM-03-04	Performance Analytical	VOCs, Methane, TNMOC	
	5/3/98	USEPA	12633	USEPA Region 9 lab	VOCs, Methane, TNMOC	Split Sample
	11/9/98	WDIG	WDI-IBM03B-06	Performance Analytical	VOCs, Methane, TNMOC	
12635 Los Nietos Rd.	9/15/97	USEPA	SYN551	USEPA Region 9 lab	VOCs	
Stansell Brothers	9/15/97	USEPA	SYN552	USEPA Region 9 lab	VOCs	Field Duplicate
	2/9/98	WDIG	WDI-IBM03-01	Performance Analytical	VOCs, Methane, TNMOC	
	2/9/98	USEPA	12635 Los Nietos	Quanterra	VOCs, Methane, TNMOC	Split Sample
	7/1/98	WDIG	WDI-IBM03-05	Performance Analytical	VOCs, Methane, TNMOC	
	11/9/98	WDIG	WDI-IBM03-06	Performance Analytical	VOCs, Methane, TNMOC	
12637A Los Nietos Rd.	8/11/97	USEPA	SYN545	USEPA Region 9 lab	VOCs	
Buffalo Bullet	2/9/98	WDIG	WDI-IBM24B-01	Performance Analytical	VOCs, Methane, TNMOC	
	3/9/98	WDIG	WDI-IBM24B-02	Performance Analytical	VOCs, Methane, TNMOC	
	3/9/98	WDIG	WDI-IBM24B-02dup	Performance Analytical	VOCs, Methane, TNMOC	Field Duplicate
	4/6/98	WDIG	WDI-IBM24B-03	Performance Analytical	VOCs, Methane, TNMOC	
	5/3/98	WDIG	WDI-IBM24B-04	Performance Analytical	VOCs, Methane, TNMOC	
	5/3/98	USEPA	12637	USEPA Region 9 lab	VOCs, Methane, TNMOC	Split Sample
	7/26/98	WDIG	WDI-IBM24B-05	Performance Analytical	VOCs, Methane, TNMOC	
	11/9/98	WDIG	WDI-IBM24B-06	USEPA Region 9 lab	VOCs, Methane, TNMOC	
12637B Los Nietos Rd	8/11/97	USEPA	SYN546	USEPA Region 9 lab	VOCs	
C & E Die Fab	8/11/97	USEPA	SYN547	USEPA Region 9 lab	VOCs	Field Duplicate
	8/25/97	USEPA	SYN501	Quanterra	VOCs, Methane, TNMOC	
	8/25/97	USEPA	SYN502	Quanterra	VOCs, Methane, TNMOC	Field Duplicate
	2/9/98	WDIG	WDI-IBM24-01	Performance Analytical	VOCs, Methane, TNMOC	
	2/9/98	USEPA	12637B Los Nietos	Quanterra	VOCs, Methane, TNMOC	Split Sample
	3/9/98	WDIG	WDI-IBM24-02	Performance Analytical	VOCs, Methane, TNMOC	
	4/6/98	WDIG	WDI-IBM24-03	Performance Analytical	VOCs, Methane, TNMOC	
	4/6/98	WDIG	WDI-IBM24-03dup	Performance Analytical	VOCs, Methane, TNMOC	Field Duplicate
	5/3/98	WDIG	WDI-IBM24-04	Performance Analytical	VOCs, Methane, TNMOC	
	5/3/98	USEPA	12637B	Quanterra	VOCs, Methane, TNMOC	Split Sample
	7/26/98	WDIG	WDI-IBM24-05	Performance Analytical	VOCs, Methane, TNMOC	
	7/26/98	WDIG	WDI-IBM24-05 dup	Performance Analytical	VOCs, Methane, TNMOC	Field Duplicate
	11/9/98	WDIG	WDI-IBM24-06	Performance Analytical	VOCs, Methane, TNMOC	
	11/9/98	WDIG	WDI-IBM24-06 dup	Performance Analytical	VOCs, Methane, TNMOC	Field Duplicate
12645 Los Nietos Rd.	8/25/97	USEPA	SYN511	USEPA Region 9 lab	VOCs	
Bell Auto Body	11/9/98	WDIG	WDI-IBM12-06	Performance Analytical	VOCs, Methane, TNMOC	
12717 Los Nietos Rd.	8/18/97	USEPA	SYN492	Quanterra	VOCs	
D & H Laminating						
12731 Los Nietos Rd.	9/15/97	USEPA	SYN553	USEPA Region 9 lab	VOCs	
Timmons Wood Products						
12741A Los Nietos Rd.	8/18/97	USEPA	SYN490	Quanterra	VOCs, Methane, TNMOC	
Dan Ray	8/18/97	USEPA	SYN491	Quanterra	VOCs, Methane, TNMOC	Field Duplicate
12741B Los Nietos Rd.	9/22/97	USEPA	SYN577	Quanterra	VOCs, Methane, TNMOC	
Peoples						
12747 Los Nietos Rd.	8/4/97	USEPA	SYN537	USEPA Region 9 lab	VOCs	
California Reamer	4/6/98	WDIG	WDI-IBM32-03	Performance Analytical	VOCs, Methane, TNMOC	
12801B Los Nietos Rd.	8/25/97	USEPA	SYN510	USEPA Region 9 lab	VOCs	
Vacant						
12803A Los Nietos Rd.	8/25/97	USEPA	SYN515	USEPA Region 9 lab	VOCs	
Durango Plastics						

TABLE 3-2 (continued)
SUMMARY OF IN-BUSINESS AIR SAMPLING
AUGUST 1997 THROUGH NOVEMBER 1998, USEPA and WDIG SAMPLING EVENTS

Sample Location Address/Business	Sample Date	Sampler	Sample ID	Laboratory	Analysis	Comment
12807A Los Nietos Rd.	8/18/97	USEPA	SYN487	Quanterra	VOCs	
Four C's Transmission						
12809B Los Nietos Rd.	8/18/97	USEPA	SYN486	Quanterra	VOCs	
Bert's Auto Body						
12811C Los Nietos Rd.	8/18/97	USEPA	SYN488	Quanterra	VOCs	
Leo's Lawnmower						
12811D Los Nietos Rd.	8/18/97	USEPA	SYN489	Quanterra	VOCs	
Hernandez Auto						
12811F Los Nietos Rd.	2/9/98	WDIG	WDI-IBM41-01	Performance Analytical	VOCs, Methane, TNMOC	
H & H Contractors	3/9/98	WDIG	WDI-IBM41-02	Performance Analytical	VOCs, Methane, TNMOC	
	4/6/98	WDIG	WDI-IBM41-03	Performance Analytical	VOCs, Methane, TNMOC	
	5/3/98	WDIG	WDI-IBM41-04	Performance Analytical	VOCs, Methane, TNMOC	
	5/3/98	USEPA	12811F	Quanterra	VOCs, Methane, TNMOC	Split Sample
	7/1/98	WDIG	WDI-IBM41-05	Performance Analytical	VOCs, Methane, TNMOC	
	11/9/98	WDIG	WDI-IBM41-06	Performance Analytical	VOCs, Methane, TNMOC	
9608 Santa Fe Springs Rd.	8/25/97	USEPA	SYN514	USEPA Region 9 lab	VOCs	
Rollands Welding						
9610 Santa Fe Springs Rd.	8/25/97	USEPA	SYN512	USEPA Region 9 lab	VOCs	
Lift Truck Converter	8/25/97	USEPA	SYN513	USEPA Region 9 lab	VOCs	Field Duplicate
9618 Santa Fe Springs Rd. #8	9/15/97	USEPA	SYN556	USEPA Region 9 lab	VOCs	
Vacant						
9618 Santa Fe Springs Rd. #10	9/15/97	USEPA	SYN555	USEPA Region 9 lab	VOCs	
Vacant	9/15/97	USEPA	SYN559	USEPA Region 9 lab	VOCs	Field Duplicate
9618 Santa Fe Springs Rd. #12	9/15/97	USEPA	SYN554	USEPA Region 9 lab	VOCs	
Vacant						
9618 Santa Fe Springs Rd. #15	8/11/97	USEPA	SYN542	USEPA Region 9 lab	VOCs	
Lovell Cabinets						
9620A Santa Fe Springs Rd.	8/4/97	USEPA	SYN533	USEPA Region 9 lab	VOCs	
Action Maintenance						
9620B Santa Fe Springs Rd.	8/4/97	USEPA	SYN534	USEPA Region 9 lab	VOCs	
Dry Print						
9632 Santa Fe Springs Rd.	8/4/97	USEPA	SYN535	USEPA Region 9 lab	VOCs	
E & L Electric	8/25/97	USEPA	SYN499	Quanterra	VOCs, Methane, TNMOC	
	8/25/97	USEPA	SYN500	Quanterra	VOCs, Methane, TNMOC	Field Duplicate
	2/9/98	WDIG	WDI-IBM22-01	Performance Analytical	VOCs, Methane, TNMOC	
	2/9/98	USEPA	9632 Santa Fe	Quanterra	VOCs, Methane, TNMOC	Split Sample
	4/6/98	WDIG	WDI-IBM22-03	Performance Analytical	VOCs, Methane, TNMOC	
9640 Santa Fe Springs Rd.	8/4/98	USEPA	SYN536	USEPA Region 9 lab	VOCs	
Mersits Equipment						
9756 Santa Fe Springs Rd. Bldg#1	8//18/97	USEPA	SYN483	Quanterra	VOCs	
Air Liquide						
9756 Santa Fe Springs Rd. Bldg#2	8//18/97	USEPA	SYN485	Quanterra	VOCs	
Air Liquide						
9756 Santa Fe Springs Rd. Bldg#3	8//18/97	USEPA	SYN484	Quanterra	VOCs	
Air Liquide						
Corner of Los Nietos and Greenleaf	8/4/97	USEPA	SYN557	USEPA Region 9 lab	VOCs	
Ambient air background	8/10/97	USEPA	SYN549	USEPA Region 9 lab	VOCs	
	8/25/97	USEPA	SYN518	USEPA Region 9 lab	VOCs, Methane, TNMOC	
	9/21/97	USEPA	SYN581	Quanterra	VOCs, Methane, TNMOC	
	2/9/98	USEPA	AMB	Quanterra	VOCs, Methane, TNMOC	Split Sample
	2/9/98	WDIG	WDI-IBM49-01	Performance Analytical	VOCs, Methane, TNMOC	
	3/9/98	WDIG	WDI-IBM49-02	Performance Analytical	VOCs, Methane, TNMOC	
	4/6/98	WDIG	WDI-IBM49-03	Performance Analytical	VOCs, Methane, TNMOC	
	5/3/98	USEPA	AMB	Quanterra	VOCs, Methane, TNMOC	Split Sample
	5/3/98	WDIG	WDI-IBM49-04	Performance Analytical	VOCs, Methane, TNMOC	
	7/1/98	WDIG	WDI-IBM49-05	Performance Analytical	VOCs, Methane, TNMOC	
	11/9/98	WDIG	WDI-IBM49-06	Performance Analytical	VOCs, Methane, TNMOC	

Section 4.0

4.0 SOIL GAS CHEMICALS OF CONCERN AND INTRODUCTION OF SOIL GAS PERFORMANCE STANDARDS

Investigations conducted since 1989 have identified and confirmed relatively high concentrations of methane and a variety of VOCs in soil gas sampled at specific locations of the WDI site. The purpose of this section is to provide background information on determining the soil gas chemicals of concern (COCs) and to introduce provisional soil gas performance standards that will serve as the basis for remedial action and compliance standards in the final site ROD. The following topics are addressed in this section:

- A brief review of the interim threshold screening levels developed for and used during USEPA's 1997 subsurface gas investigation and in-business air sampling.
- A description of the approach and results of an updated assessment of soil gas COCs at the site based on the extensive set of sampling data collected in 1997-1998 by the USEPA and the WDIG.
- Development of the provisional performance standards for the WDI soil gas COCs based on the evaluation of COC concentrations and frequency of detection.
- A summary of the technical basis for the USEPA's ambient air preliminary remediation goals and the physical and toxicological properties of the primary chemicals found in soil gas at the WDI site.

4.1 INTERIM SOIL GAS THRESHOLD SCREENING LEVELS

During the 1997 subsurface gas investigations, the USEPA developed interim threshold screening levels (ITSLs) to initially evaluate soil gas conditions and to identify areas of potential concern for soil gas migration and human health exposure. The ITSLs developed and presented in the *Subsurface Gas Contingency Plan* (CDM Federal, 1997) are listed in Table 4-1. The ITSLs were based on the 1996 ambient air preliminary remediation goals (PRGs) established by USEPA Region 9 for a list of 20 VOCs that were identified during the initial 1989 and 1995 sampling. The ITSLs represent field screening levels for chemicals detected in soil gas and in-business air. The primary purpose of the ITSLs was to provide an initial basis for determining a need for additional field studies based on an exceedance of a screening level. The ITSLs were used to identify locations for additional permanent soil gas monitoring wells and for more frequent in-business air monitoring (see Section 3). The ITSLs were not intended to represent ROD performance standards. The remainder of Section 4 addresses the development of the soil gas performance standards.

4.2 IDENTIFICATION OF CHEMICALS OF CONCERN

The recent soil gas investigations conducted by the USEPA and WDIG have resulted in a more comprehensive characterization of subsurface gas conditions at WDI. Using the extensive set of sampling results collected in 1997-1998, an updated assessment of the soil gas data was performed to confirm and refine the list of soil gas COCs for the site. The results of this assessment are summarized in Table 4-2.

The following criteria were used for identifying and selecting soil gas COCs: (1) frequency of detection, (2) maximum concentration, and (3) comparison with "evaluation concentrations" based on current USEPA Region 9 ambient air PRGs (USEPA, 1998). Table 4-2 lists the frequency of detection (percentage) and maximum concentration detected for all of the VOCs reported for the soil gas sampling and analyses conducted in 1997-1998. The evaluation concentrations listed in Table 4-2 were derived from the 1998 ambient air PRGs and applying an attenuation factor of 100 to account for the estimated dilution of chemicals in soil gas to in-business air. The following risk management criteria were used to develop the evaluation concentrations:

- If a chemical is a known carcinogen, the PRG at the 1E-6 cancer risk level was multiplied by an attenuation factor of 100.
- If a chemical is a probable carcinogen, the PRG at the 1E-5 cancer risk level was multiplied by an attenuation factor of 100.
- If a chemical is a possible carcinogen, the PRG at the 1E-4 cancer risk level was multiplied by an attenuation factor of 100.
- If a chemical is noncarcinogenic, the PRG at a hazard quotient of 1 was multiplied by 100.

A chemical was determined to be a COC if, (1) the chemical was detected in more than five percent of the soil gas samples, and (2) the maximum concentration of the chemical in soil gas exceeds the PRG-based evaluation concentration. Based on this evaluation, a total of 16 VOCs were identified as soil gas COCs as listed in Table 4-2. While the maximum concentration for ethylbenzene did not exceed the

PRG-based evaluation concentration, it was selected as a COC because it is a contaminant typically present in the buried waste and thus, an indicator chemical of buried waste.

4.3 PROVISIONAL SOIL GAS PERFORMANCE STANDARDS

The 1998 PRG-based evaluation concentrations described above were used to develop provisional performance standards for the COCs found in soil gas at the WDI site. Table 4-3 lists the provisional performance standards for the soil gas COCs developed as part of this evaluation and summarizes the rationale and basis for developing these standards. The provisional soil gas performance standards are based on the "evaluation concentrations" listed in Table 4-2, with some values rounded off to one significant digit. The provisional soil gas performance standards for the soil gas COCs listed in Table 4-3 will serve as a basis for establishing remedial action and compliance standards in the final site ROD.

Additional background and the technical basis for the development of the USEPA ambient air PRGs and the physical and toxicological properties of the soil gas COCs are described in the following section.

4.4 PHYSICAL AND TOXICOLOGICAL PROPERTIES

Table 4-4 summarizes the physical and toxicological properties of the chemicals frequently detected in soil gas at the WDI site. The vapor pressures shown in Table 4-4 provide a relative measure of the volatility of chemicals in their pure state. The following text describes the development of the USEPA Region 9 PRGs for ambient air and, for comparison purposes, provides the Permissible Exposure Limits (PELs) developed and enforced by the Occupational Safety and Health Administration (OSHA). Additionally described are the potential adverse effects that could occur from exposure to the COCs.

4.4.1 Ambient Air Screening Levels

Preliminary Remediation Goals

Table 4-4 lists the preliminary remediation goals (PRGs) developed by the USEPA Region 9 for chemicals of potential concern in ambient air (USEPA, 1998). PRGs represent chemical concentrations that are protective of humans, including sensitive groups, over a lifetime. To develop the PRGs shown in

Table 4-4, the USEPA combined toxicity and exposure factors to estimate chemical concentrations in air that correspond to acceptable levels of risk. The methods used by the USEPA to estimate these acceptable levels of risk, including the exposure factors and toxicity values, are described below.

Standard exposure factors used to develop the PRGs include the following: inhalation rates of 20 m^3/day for adults and 10 m^3/day for children; an exposure duration of 30 years; and an exposure frequency of 350 days per year. These exposure factors are standard default factors commonly used for people living at home and are not representative of the current industrial scenario at WDI. It is recognized that application of standard default factors for an industrial setting would raise the concentrations of the PRGs slightly. However, the difference (approximately a factor of two for the air pathway) is considered by the USEPA to be so small that it does not justify a separate list of screening levels for industrial versus residential land use.

Inhalation reference doses (RfDs) and cancer slope factors are the toxicological factors that the USEPA uses to develop the PRGs. The USEPA derives these toxicological factors from the most up-to-date chronic toxicological data available from human and/or animal studies. RfDs are based on potential noncarcinogenic effects and represent an estimate of a daily exposure concentration that will not result in adverse effects over a lifetime of exposure. This critical concentration is usually the No-Observed-Adverse Effect Level (NOAEL) estimated from animal or human studies. To establish the RfD, the NOAEL is divided by uncertainty factors to account for sensitive humans, extrapolation of animal data to humans, and extrapolation of acute or subchronic exposure to chronic exposure. Cancer slope factors are based on the carcinogenic potential of a chemical and represent an upper-bound estimate of the cancer risk per unit dose.

The USEPA combines the RfDs and slope factors with the standard exposure factors to estimate acceptable risk levels in air. For noncarcinogens, PRG concentrations equate to a hazard quotient (HQ) of 1 (Exposure/RfD = HQ). The hazard quotient assumes there is a threshold level below which it is unlikely for even sensitive populations to experience adverse health effects. If this threshold level is exceeded, there may be concern for adverse health effects. For carcinogens, the USEPA uses a 1×10^{-6} cancer risk level to establish the PRG. This represents an increased incidence of cancer of one-in-one million people. The USEPA recognizes that there is a range of acceptable cancer risk levels (1×10^{-4} to 1×10^{-6}) that may be used in risk management decisions at a site.

Permissible Exposure Limits

OSHA has developed PELs to protect employees working at industrial facilities. PELs are OSHA-regulated average concentrations that must not be exceeded for any 8-hour work shift of a 40-hour workweek. The ambient air concentration may sometimes go above the PEL value, as long as the 8-hour average stays below. OHSA established PELs in 1971 largely based on the 1968 Threshold Limit Values (TLVs) developed by the American Conference of Governmental Industrial Hygienists.

OSHA standards are not applicable at the WDI site because they are intended as permissible levels for healthy individuals who are knowingly exposed to chemicals as the result of their job activity. Under OSHA, workers may be routinely monitored to prevent excessive exposure to a chemical. It is also noted that adverse effects may occur in some individuals at the OSHA PEL.

PRGs, on the other hand, are intended to be protective of all individuals (not just healthy people) and are set at more stringent levels than PELs because exposures are involuntary unlike exposures that are regulated under OSHA. Because of these differences, PRGs set by the USEPA may be more than 100 times more stringent than OSHA PELs.

4.4.2 Adverse Health Effects

The following section describes the adverse health effects people could experience from exposure to COCs present in soil gas at the WDI site. These health effects are inferred from either animal studies or from studies of people manufacturing or using these chemicals. The reader should consider most of the adverse health effects described below as potential health effects that are unlikely to occur at WDI. Building occupants and site personnel at WDI are unlikely to be exposed to the same levels that caused adverse health effects in human and animal studies. Laboratory studies with animals typically use chemical concentrations that are much higher than encountered in the workplace. Human studies also use data from scenarios that are unlikely to occur at WDI. Chloroform, for example, was once used as an anesthetic and PCE and TCE were much more commonly used as degreasers in the past.

The potential for adverse health effects is dependent upon the duration and magnitude of exposure. Short-term exposure to high levels (10,000 ppm) of the chemicals of potential concern can result in common central nervous system effects such as nausea, drowsiness, dizziness, headaches, unconsciousness, and even death. Long-term exposure to low levels of the chemicals of potential concern may cause cancer or damage to the liver, kidneys, heart, and other internal organs. For many chemicals, the carcinogenic potential is inconclusive. Animal studies may suggest a chemical is carcinogenic, while human studies may not. For this reason, the USEPA classifies chemicals into one of the following groups, according to the weight of evidence of cancer.

Group A - human carcinogen (sufficient evidence of carcinogenicity in humans)

Group B - probable human carcinogen (B1 - limited evidence of carcinogenicity in humans; B2 - sufficient evidence of carcinogenicity in animals with inadequate or lack of evidence in humans)

Group C - possible human carcinogen (limited evidence of carcinogenicity in animals and inadequate or lack of human data)

Group D - not classifiable as to human carcinogenicity

The potential noncarcinogenic and carcinogenic health effects of the primary COCs associated with the WDI site are summarized below.

1,2-Dichloroethane. Breathing high levels of 1,2-dichloroethane (DCA) can cause damage to the heart, central nervous system, liver, kidneys, and lungs. The effects in people breathing or ingesting low levels of 1,2-DCA are not known. Studies in animals have shown breathing or ingesting 1,2-DCA can damage the nervous system and kidney. Other effects shown in animals include a reduced ability to fight infection. The USEPA has classified 1,2-DCA as a Group B2 carcinogen. There is sufficient evidence that 1,2-DCA is carcinogenic in laboratory animals, but inadequate evidence in humans that 1,2-DCA is carcinogenic.

1,2-Dichloroethene (cis and trans). Breathing high levels of 1,2-dichloroethene (DCE) can cause nausea, dizziness, drowsiness, and even death. Animal studies have shown breathing high levels of 1,2-DCE can damage the liver, heart, and lungs. Ingesting lower levels of 1,2-DCE has caused decreased numbers of red blood cells in animals. The long-term health effects of 1,2-DCE are not known. Neither birth defects nor cancer have been reported in animals or humans exposed to 1,2-DCE.

1,2-Dichloropropane. In the early 1980s, 1,2-dichloropropane was used as a soil fumigant and was found in paint strippers, varnishes, and furniture finish removers. Breathing high levels of 1,2-dichloropropane, can cause nausea, dizziness, drowsiness, anemia, injury to the liver and kidneys, and even death. Animal studies have shown breathing low levels of 1,2-dichloropropane for long-term periods can damage the liver, kidney, and lungs. The USEPA has classified 1,2-dichloropropane as a Group B2 carcinogen. Short-term exposure has not shown 1,2-dichloropropane to cause cancer in humans, but long-term exposure has produced evidence of liver cancer in mice and breast cancer in rats.

Benzene. Benzene is a natural component of crude oil and petroleum products and people are commonly exposed to benzene at automobile service stations and from exhaust, industrial emissions, and tobacco smoke. Breathing high levels of benzene (700 to 3,000 ppm) can cause drowsiness, dizziness, headaches, unconsciousness, and even death at levels of 10,000 to 20,000 ppm. Long-term exposure to benzene can result in damage to the reproductive system, the immune system, and can cause cancer of the tissues that form white blood cells (leukemia). Benzene is a known human carcinogen (Group A).

Chloroform. In the past, chloroform was used as an anesthetic during surgery before its harmful effects on the liver and kidneys were recognized. Breathing about 900 ppm chloroform can cause tiredness, dizziness, and headache and breathing 8,000 to 10,000 ppm chloroform for a short time can cause unconsciousness and death. Long-term exposure to low levels of chloroform can damage the liver and kidneys. A possible link has been shown between people who drank water with chloroform and the occurrence of cancer of the colon and urinary bladder.

Tetrachloroethene. Breathing high concentrations of tetrachloroethene (PCE) can result in dizziness, headache, sleepiness, confusion, nausea, unconsciousness, and even death. Studies of women using PCE in the dry cleaning business suggest that PCE may cause menstrual problems and spontaneous abortions. Animal studies indicate high levels of PCE can cause liver and kidney damage. Currently the USEPA's cancer classification for PCE is under review; however, previously PCE was classified as a B2 carcinogen.

Trichloroethene. Breathing high concentrations of trichloroethene (TCE) may cause dizziness, headache, slowed reaction time, sleepiness, and facial numbness. Animal studies indicate breathing high levels of TCE may cause damage to the central nervous system, liver, kidneys, blood, and lungs.

Currently the USEPA's cancer classification for TCE is under review; however, previously TCE was classified as a B2 carcinogen.

Vinyl Chloride. Breathing high levels of vinyl chloride (10,000 ppm) can cause dizziness and sleepiness. Animal studies indicate breathing high levels of vinyl chloride can cause damage to the liver, lungs, kidneys, and heart. Human and animal studies indicate long-term exposure may result in reproductive effects such as lack of sex drive, irregular menstrual periods, damage to the sperm and testes in animals, and birth defects in animals. Vinyl chloride is a known human carcinogen (Group A). Workers who have breathed vinyl chloride over many years have developed liver cancer. Long-term exposure to vinyl chloride may also cause brain cancer, lung cancer, and cancers of the blood.

Table 4-1
Interim Threshold Screening Levels Used for 1997 Soil Gas Investigations
Waste Disposal, Inc. Site

Chemical	Interim Threshold Screening Levels (ppbv)		
	Soil Gas	Site Boundary	Indoor Air
Acetone	31,200	15,600	312
Benzene	200	100	2.0
Carbon Tetrachloride	68	34	0.68
Chloroethane	75,200	37,600	752
Chloroform	340	170	3.4
1,2-Dibromoethane	6	3.4	0.06
1,1-Dichloroethane	25,600	12,800	256
1,2-Dichloroethane	360	180	3.6
cis-1,2-Dichloroethene	1,860	930	18.6
trans-1,2-Dichloroethene	3,680	1,840	36.8
1,2-Dichloropropane	186	93	1.86
Ethylbenzene	49,000	24,500	490
Tetrachloroethene	1,064	532	10.6
Toluene	21,200	10,600	212
1,1,2-Trichloroethane	440	220	4.4
1,1,1-Trichloroethane	36,800	18,400	368
Trichloroethene	822	411	8.2
Vinyl Chloride	25	12.5	0.25
m,p-Xylenes	14,280	7,140	142.8
o-Xylene	14,280	7,140	142.8
Methane	5.0 %	1.25 %	1.25 %

NOTE:

Interim threshold screening levels (ITSLs) were developed for USEPA's 1997 Subsurface Gas Contingency Plan.

ITSLs are based on the 1996 USEPA Region 9 ambient air preliminary remediation goals (PRGs).

The list of soil gas chemicals was based on the results of the 1989 and 1995 sampling of selected vapor wells.

Table 4-2
Summary of Soil Gas Sampling Data Used for Selecting Chemicals of Concern
Waste Disposal, Inc. Site

		Detection Frequency (1)				
Compound Selected as COC	Volatile Organic Compounds	Times Detected	No. of Samples	% Detect	Maximum Concentration	PRG-Based Concentration Used to Select COCs (2)
	TO-15 Target Compounds				(ppbv)	(ppbv)
	Dichlorodifluoromethane (Freon 12)	6	152	3.9	1.9	4,300
	Chloromethane	20	411	4.9	1,300	530
X	Vinyl Chloride	92	411	22	6,500	0.86
	1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND	152			
	Bromomethane	2	411	0.5	1.2	130
	Chloroethane	8	411	2	24	376,900
X	1,1-Dichloroethene	62	411	15	290	100
	Trichlorofluoromethane	88	411	21	4.6	13,100
	1,1,2-Trichloro-1,2,2-trifluoroethane	4	71	6	130	406,000
	Methylene Chloride	62	411	15	580	1200
X	trans-1,2-Dichloroethene	35	411	9	4,700	1,846
	1,1-Dichloroethane	116	411	28	190	128,000
X	cis-1,2-Dichloroethene	96	411	23	8,000	936
X	Chloroform	122	411	30	820	17
	1,1,1-Trichloroethane	199	411	48	3,700	18,400
	Carbon Tetrachloride	4	411	1	78	21
X	Benzene	163	411	40	64,000	7.2
X	1,2-Dichloroethane	56	411	14	240	1
X	Trichloroethene	223	411	54	3,900	206
X	1,2-Dichloropropane	26	411	6	250	22
	cis-1,3-Dichloropropene	ND	411			9,360
X	Toluene	231	411	56	17,000	10,700
	trans-1,3-Dichloropropene	1	411	0.2	0.88	11
	1,1,2-Trichloroethane	3	411	1	50	221
X	Tetrachloroethene	301	411	73	1,400	488
	1,2-Dibromoethane (EDB)	1	411	0.2	0.46	1.1
	Chlorobenzene	18	411	4	300	455
X	Ethylbenzene	98	411	24	7,200	25,400
X	m- & p-Xylene	173	411	42	23,000	16,900
X	o-Xylene	104	411	25	7,300	16,900
	Styrene	3	411	1	201	25,900
	1,1,2,2-Tetrachloroethane	2	411	0.5	2.9	48
X	1,3,5-Trimethylbenzene	7	121	6	2,700	127
X	1,2,4-Trimethylbenzene	18	108	17	5,000	127
	1,3-Dichlorobenzene	4	411	1	1.2	140
	1,4-Dichlorobenzene	7	411	2	1.5	46.7
	1,2-Dichlorobenzene	11	411	3	57	3,500
	Additional Compounds (TO-14)					
	Acetone	187	303	62	6,414	15,600
	Trichlorotrifluoromethane	66	259	25	130	NA
	Carbon Disulfide	153	259	59	1,100	23,500
	Methyl tert-Butyl Ether (MTBE)	114	259	44	34	86,100
	Vinyl Acetate	7	259	3	280	5,980
	2-Butanone	73	195	37	89	34,000
	Bromodichloromethane	28	297	9	13	16.4
	4-Methyl-2-Pentanone	7	259	3	1.3	NA
	2-Hexanone	2	259	1	2.1	NA
	Dibromochloromethane	19	259	7	6.7	94
	Bromoform	12	259	5	7.1	165

NOTES: (1) Table lists the maximum concentration and detection frequency for all VOCs analyzed in WDI soil gas samples, 1997 - 1998.

(2) The PRG-based concentrations used to select COCs are based on the 1998 Region 9 PRGs for ambient air (see text for discussion).

Table 4-3
Provisional Soil Gas Performance Standards
Waste Disposal, Inc. Site

Chemical of Concern (1)	1998 USEPA Ambient Air PRG (2) (ppbv)	Toxicological Basis for Ambient Air PRG	Provisional Soil Gas Performance Standard (ppbv)	Rationale for the Development of the Provisional Soil Gas Performance Standard
1,2-Dichloroethane	0.02	probable carcinogen	20	(PRG at 1E-5 cancer risk level) x (attenuation factor) = 0.2 ppbv x 100
1,1-Dichloroethene	0.01	possible carcinogen	100	(PRG at 1E-4 cancer risk level) x (attenuation factor) = 1 ppbv x 100
1,2,4-Trimethylbenzene	1	noncarcinogenic	100	(PRG at HQ = 1) x (attenuation factor of 100)
1,2-Dichloroethene (cis)	9	noncarcinogenic	900	(PRG at HQ = 1) x (attenuation factor of 100)
1,2-Dichloroethene (trans)	20	noncarcinogenic	2,000	(PRG at HQ = 1) x (attenuation factor of 100)
1,2-Dichloropropane	0.02	probable carcinogen	20	(PRG at 1E-5 cancer risk level) x (attenuation factor) = 0.2 ppbv x 100
1,3,5-Trimethylbenzene	1	noncarcinogenic	100	(PRG at HQ = 1) x (attenuation factor of 100)
Benzene	0.1	known carcinogen	10	(PRG at 1E-6 cancer risk level) x (attenuation factor) = 0.1 ppbv x 100
Chloroform	0.02	probable carcinogen	20	(PRG at 1E-5 cancer risk level) x (attenuation factor) = 0.2 ppbv x 100
Ethylbenzene	250	noncarcinogenic	25,000	(PRG at HQ = 1) x (attenuation factor of 100)
Xylenes	200	noncarcinogenic	20,000	(PRG at HQ = 1) x (attenuation factor of 100)
Tetrachloroethene	0.5	probable carcinogen	500	(PRG at 1E-5 cancer risk level) x (attenuation factor) = 5 ppbv x 100
Toluene	100	noncarcinogenic	10,000	(PRG at HQ = 1) x (attenuation factor of 100)
Trichloroethene	0.2	probable carcinogen	200	(PRG at 1E-5 cancer risk level) x (attenuation factor) = 2 ppbv x 100
Vinyl chloride	0.01	known carcinogen	1	(PRG at 1E-6 cancer risk level) x (attenuation factor) = 0.01 ppbv x 100

(1) See text for the criteria used to select soil gas chemicals of concern.

(2) 1998 USEPA Region 9 Preliminary Remediation Goals (PRGs) at the 1E-6 cancer risk level (converted from units of ug/m3) or the hazard quotient equal to 1.
Except for ethylbenzene, values were rounded off to 1 significant digit.

HQ = hazard quotient

Table 4-4
PHYSICAL AND TOXICOLOGICAL CHARACTERISTICS OF CHEMICALS DETECTED IN SOIL GAS AT WDI

Chemical of Potential Concern	Molecular Weight (g/mol)	Vapor Pressure (mm Hg)	USEPA Ambient Air PRG (1) (ppbv)	(ug/m3)	Weight of Evidence for Cancer (2)	Inhalation RfD mg/kg-day	Inhalation Slope Factor (mg/kg-day)-1
CHEMICALS OF CONCERN							
1,2-Dichloroethane	98.96	64.0	0.018	0.074	B2	2.9E-03	9.1E-02
1,1-Dichloroethene	97.0	600	0.010	0.038	C	9.0E-03	1.8E-01
1,2,4-Trimethylbenzene	120		1.3	6.2	N/A	1.7E-03	N/A
1,2-Dichloroethene (cis)	96.9	208	9.4	37	D	1.0E-02	N/A
1,2-Dichloroethene (trans)	96.9	324	18	73	N/A	2.0E-02	N/A
1,2-Dichloropropane	113	42	0.021	0.099	B2	1.10E-03	6.3E-02
1,3,5-Trimethylbenzene	120		1.3	6.2	D	1.7E-03	N/A
Benzene	78.1	95	0.072	0.23	A	1.7E-03	1.0E-01
Chloroform	119	151	0.017	0.084	B2	1.0E-02	8.1E-02
Ethylbenzene	106	7.0	254	1,100	D	2.9E-01	N/A
m-Xylene	106	10	169	730	D	2.0E-01	N/A
o-Xylene	106	10	169	730	D	2.0E-01	N/A
p-Xylene	106	10		N/A	D	N/A	N/A
Tetrachloroethene	165.8	18	0.49	3.3	B2	1E-02	2.1E-02
Toluene	92.0	28	107	400	D	1.1E-01	N/A
Trichloroethene	131	58	0.21	1.1	B2	6E-03	1.0E-02
Vinyl chloride	62.5	2,660	0.0086	0.022	A	N/A	2.7E-01
OTHER COMPOUNDS DETECTED							
1,1,1-Trichloroethane	133	123	184	1,000	D	2.9E-01	N/A
1,1,2,2-Tetrachloroethane	168	5.0	0.0048	0.033	C	N/A	2.0E-01
1,1,2-Trichloroethane	133	30	0.022	0.12	C	4.0E-03	5.6E-02
1,1-Dichloroethane	99.0	64	129	520	C	1.4E-01	N/A
1,2-Dibromoethane	188		0.0011	0.0087	B2	5.7E-05	7.7E-01
1,2-Dichlorobenzene	147	1.0	35	210	D	5.7E-02	N/A
1,3-Dichlorobenzene	147	2.3	1.4	8.4	D	2.3E-03	N/A
1,4-Dichlorobenzene	147	1.2	0.047	0.28	C	2.3E-01	2.4E-02
2-Butanone (MEK)	72.0	77.5	340	1,000	D	2.9E-01	N/A
2-Hexanone				N/A	N/A	N/A	N/A
4-Methyl-2-Pentanone				N/A	N/A	N/A	N/A
Acetone	58.0	270	156	370	D	1.0E-01	N/A
Bromodichloromethane	164		0.016	0.11	B2	2.0E-02	6.2E-02
Bromoform	253	5.0	0.16	1.7	B2	2.0E-02	3.9E-03
Bromomethane	95.0		1.3	5.2	D	1.4E-03	N/A
Carbon disulfide	76.0	360	235	730	N/A	2.0E-01	N/A
Carbon tetrachloride	154	90	0.021	0.13	B2	5.7E-04	5.3E-02
Chlorobenzene	113	12	4.6	21	D	5.7E-03	N/A
Chloroethane	65.0		3,769	10,000	N/A		
Chloromethane	51.0		0.53	1.1	C	1.3E-02	6.3E-03
1,3-Dichloropropene	111	25	0.011	0.052	B2	5.7E-03	1.30E-01
Dibromochloromethane	208.28		0.00941	0.080	C	2.0E-02	8.4E-02
Dichlorodifluoromethane	121		43	210	N/A	5.7E-02	N/A
Dichlorotetrafluoroethane				N/A	N/A	N/A	N/A
Methyl tert-butyl ether	88.15		862	3,100	N/A	8.6E-01	N/A
Methylene Chloride	85.0	362	1.2	4.1	B2	8.6E-01	1.6E-03
Styrene	104		259	1,100	N/A	2.9E-01	N/A
Trichlorofluoromethane	137		131	730	N/A	2.0E-01	N/A
Trichlorotrifluoroethane	187.0		4,061	31,000	N/A	8.6E+00	N/A
Trichlorotrifluoromethane	187			N/A	N/A	N/A	N/A
Vinyl acetate	86.0		60	210	N/A	5.7E-02	N/A

N/A = Not Available

(1) 1998 USEPA Region 9 Preliminary Remediation Goals (developed for a residential scenario). PPBV = (xx ug/m3) x 24.45/molecular weight

(2) USEPA Carcinogenic Weight of Evidence Classification

A - Human carcinogen

B1 - Probable human carcinogen - indicates that limited human data are available

B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans

C - Possible human carcinogen

D - Not classifiable as a human carcinogen

5.0 SOIL GAS EVALUATION

Presented in this section is an evaluation of soil gas investigation and monitoring data collected at the WDI site. The purpose of this evaluation is to define the subsurface gas conditions at the site and assess the patterns, trends, and potential exposure pathways for the soil gas COCs. The goal of this evaluation is to establish a basis for evaluating the needs and requirements for soil gas migration control and the long-term monitoring to be implemented for final site closure.

5.1 OVERVIEW OF EVALUATION

As discussed in Section 3, soil gas sampling and investigations were conducted at WDI in 1989, 1995, and 1997-1998 resulting in an extensive set of analytical monitoring data to characterize subsurface gas conditions. The following approach and data sets were reviewed to conduct this evaluation:

- Review the 1989 and 1995 soil gas data for the single-screen RI vapor monitoring wells to assess soil gas conditions documented during the initial soil gas investigations and sampling conducted at WDI (refer to Section 3.1 for results).
- Review the results of the 1997 subsurface gas investigation (RI vapor wells and temporary gas probe sampling) to expand the scope of testing and characterization (comprehensive list of analytes and site-wide investigation).
- Review the results of the August 1998 vapor sampling of the reservoir grid piezometers conducted by the USEPA-ERT which characterized subsurface gas conditions within the buried reservoir.
- Compile and review in detail the January through July 1998 soil gas data collected from the current network of vapor monitoring wells (63 permanent sampling locations) to identify areas of high soil gas concentrations and evaluate the distribution and data trends for the primary soil gas COCs.

5.2 USEPA 1997 SUBSURFACE GAS INVESTIGATIONS

As discussed in Section 3.1, the USEPA's 1997 SGCP investigation involved soil gas sampling from 186 temporary soil probes installed throughout the site and multiple sampling/analyses from the existing 25 RI vapor monitoring wells, generating an extensive data set for soil gas characterization at the WDI site. The compounds detected and confirmed in soil gas included methane, over 35 VOCs, and more than 75 tentatively identified compounds (TICs). Most of the TICs were nonchlorinated hydrocarbons such as derivatives of butane, pentane, hexane, cyclohexane, and cylcopentane. The VOCs most frequently detected in soil gas included chlorinated solvent-related compounds such as TCE, PCE, and vinyl chloride and petroleum-related compounds such as benzene, toluene, ethylbenzene, and xylenes (BTEX). The temporary soil probe data indicated local areas of elevated methane and VOCs in soil gas which had not been delineated during the initial vapor well sampling. Additional details on the results and findings of the 1997 investigation are presented in the *Subsurface Gas Contingency Plan Investigation Report* (CDM Federal, 1999a).

5.3 USEPA/ERT 1998 RESERVOIR VAPOR SAMPLING

As part of the USEPA-ERT site characterization studies conducted during the summer 1998, vapor samples from piezometers and wells installed within the buried reservoir were collected and analyzed using different techniques and methods. The ERT reservoir vapor sampling generated the following analytical data: (1) field GC/PID analyses from the complete set (total 58) reservoir grid piezometers, (2) laboratory analyses (after desorption) of TENAX passive soil gas samples collected from 41 grid piezometers, and (3) laboratory analysis of SUMMA canister vapor samples collected from nine selected grid piezometers. The results of this sampling and analysis study are described in USEPA-ERT (1999). Because of the comparability with the WDI soil gas sampling program, the SUMMA canister vapor sampling results are summarized below to characterize subsurface gas conditions within the buried reservoir at WDI.

The results of ERT's SUMMA canister analyses for the BTEX compounds in vapor samples collected from the reservoir grid piezometers are presented in Figure 5-1. The results of 1997 vapor analyses for monitoring well VW-09 are also shown. BTEX compounds were detected in all piezometers sampled with the highest concentrations present in the eastern, central, and southern portions of the reservoir. The highest measured BTEX concentrations were observed at reservoir piezometer H-2 (190,000 ppbv benzene, 210,000 ppbv toluene, 34,000 ppbv ethylbenzene, and 158,000 ppbv total xylenes). The piezometer vapor sampling results confirm that BTEX compounds are a characteristic component of subsurface gas within the reservoir and that total BTEX concentrations are variable and range from a low of approximately 100 ppbv (piezometer C-3) to a maximum of 592,000 ppbv (piezometer H-2).

The results of SUMMA canister analyses of chlorinated and other VOC compounds in vapor samples collected from the reservoir grid piezometers are presented in Figure 5-2. The results of 1997 vapor analyses for monitoring well VW-09 are also shown. The following VOC compounds were detected most frequently in the piezometers sampled: vinyl chloride (maximum 53,000 ppbv), TCE (maximum 73,000 ppbv), PCE (maximum 110,000 ppbv), and 1,3,5-trimethylbenzene (maximum 11,000 ppbv). DCE compounds and/or chloromethane were also detected at elevated concentrations in local areas (locations VW-09, G-1, and G-7). The piezometer sampling confirm that chlorinated VOCs are present, locally at high concentrations, in subsurface gas in the buried reservoir.

5.4 1998 VAPOR WELL MONITORING RESULTS

The sampling and analysis results for the quarterly vapor wells monitoring rounds conducted during February, April, and July 1998 were specifically selected for detailed evaluation because this set of soil gas data provides the broadest coverage of sampling locations and most recent data for defining current soil gas conditions. Based on review of the 1998 soil gas data (see Section 4.2), a subset of nine indicator chemicals were selected for specific review. The indicator soil gas chemicals were selected based on their distribution and frequency of detection at WDI and associated health risk concerns. The following chemicals were selected as indicator parameters because they are frequently detected in soil gas samples and/or are commonly detected at concentrations which exceed the ITSLs (Table 4-1):

- Vinyl Chloride
- Benzene
- TCE
- PCE
- cis 1,2-DCE
- 1,1,1-TCA
- Toluene
- m & p-Xylenes
- Methane

A cumulative sampling summary of the soil gas sampling results for the indicator chemicals is presented in Table 5-1. This table lists the maximum concentrations of the indicator chemicals reported from WDIG and USEPA sampling (February, April, and July 1998 monitoring rounds) for all of the WDI vapor monitoring wells (single-screen and multi-level probes).

To define areas and patterns of high subsurface gas concentrations, maximum concentration distribution maps have been prepared for the following COCs: methane, vinyl chloride, TCE, PCE, benzene, and toluene. These COCs were selected for presentation because of their frequency and distribution of detection and their utility as indicators of the waste sources identified at the WDI site. Additionally 1,1,1-TCA was included for mapping presentation due to its frequency and pattern of detection in the vapor monitoring well network.

For all soil gas distribution maps prepared (Figures 5-3 through 5-9), the following presentation format was followed. For the multi-level vapor monitoring wells (VW-27 through VW-63), a single value is posted reflecting the maximum chemical concentration detected from either the shallow, intermediate, or deep monitoring probes at the well location (refer to Table 5-1 for individual probe results). The chemical concentrations presented on the maps are highlighted as "high-range" concentrations, "intermediate" concentrations, and "low" concentrations. For comparison purposes, the vapor sampling results from the reservoir grid piezometers and well VW-09 are also annotated on the soil gas distribution maps.

5.4.1 Methane

The maximum concentrations of methane reported for the February-July 1998 vapor well sampling are shown on Figure 5-3. Methane levels >50% were observed at wells MP-02 (maximum 76.0%), MP-01, VW-48, and VW-25. For reference, the interim threshold screening level (ITSL) for methane is 1.25% for site and building boundary locations, and the explosion level concentration for methane is 5.0%. Methane exceeded the site boundary screening level at two locations (VW-30 and VW-40) and the building boundary screening level at eight well locations (VW-46, VW-11, VW-45, VW-62, VW-55, VW-51, MP-01, and MP-02). The sampling results indicate that the high methane concentrations occur primarily in the areas of buried sump waste west-northwest and east of the WDI reservoir.

5.4.2 Chlorinated VOCs

Maximum concentration distribution maps have been prepared for vinyl chloride, TCE, PCE, and 1,1,1-TCA. The key sampling results for these indicator chemicals are discussed below.

Vinyl Chloride. The maximum concentrations of vinyl chloride reported for the February-July 1998 vapor well sampling are shown on Figure 5-4. Vinyl chloride concentrations >100 ppbv were observed at wells VW-45 (maximum 6,500 ppbv), VW-48, VW-43, VW-14, VW-61, VW-04, and VW-10. For reference, the ITSL for vinyl chloride is 12.5 ppbv for site and building boundary locations. Vinyl chloride exceeded the building boundary screening level at 10 locations (wells VW-10, VW-44, VW-45, VW-61, VW-23, VW-53, VW-55, VW-56, VW-57, and VW-51). No exceedances of the site boundary screening level for vinyl chloride were observed during the February-July 1998 monitoring period. The sampling results indicate that the elevated vinyl chloride concentrations occur primarily in the areas of buried sump waste west-northwest and east of the WDI reservoir. Vinyl chloride above the building boundary screening level has also been confirmed in wells at the edge of buried waste south of the reservoir.

Trichloroethene. The maximum concentrations of TCE reported for the February-July 1998 vapor well sampling are shown on Figure 5-5. TCE concentrations >1,000 ppbv were observed at wells VW-58 (maximum 3,900 ppbv), VW-22, VW-35, and VW-53. For reference, the ITSL for TCE is 411 ppbv for site and building boundary locations. TCE exceeded the site boundary screening level at three locations (VW-35, VW-33, and VW-39) and the building boundary screening level at nine locations (VW-45, VW-21, VW-22, VW-23, VW-53, VW-55, VW-56, VW-57, and VW-58). The sampling results indicate that the elevated TCE concentrations occur primarily at the edge of buried waste south of the reservoir. Additionally, elevated TCE has been confirmed in the deep monitoring probes in the site perimeter wells VW-33 and VW-35.

Tetrachloroethene. The maximum concentrations of PCE reported for the February-July 1998 vapor well sampling are shown on Figure 5-6. For reference, the ITSL for PCE is 532 ppbv for site and building boundary locations. PCE exceeded the building boundary screening level at two locations (VW-51, maximum 1,400 ppbv; VW-49, 930 ppbv). No exceedances of the site boundary screening level for PCE were observed during the February-July 1998 monitoring period. The sampling results indicate that PCE in soil gas occurs primarily in the vapor well locations southwest of the WDI reservoir.

1,1,1-Trichloroethane. The maximum concentrations of 1,1,1-TCA reported for the February-July 1998 vapor well sampling are shown on Figure 5-7. 1,1,1-TCA concentrations >1,000 ppbv were observed at wells VW-39 (maximum 3,400 ppbv), VW-37, and VW-49. For reference, the ITSL for 1,1,1-TCA is 18,400 ppbv for site and building boundary locations. 1,1,1-TCA did not exceed the site or building boundary screening level at any of the vapor wells sampled during the February-July 1998 monitoring period. The sampling results indicate that the highest levels of 1,1,1-TCA in soil gas occur primarily outside of the limits of the buried waste in vapor well locations along the western and southern perimeters of the site.

5.4.3 BTEX Compounds

Maximum concentration maps have been prepared for two of the BTEX compounds: benzene and toluene. Given the characteristics of WDI waste, benzene and toluene in soil gas are considered useful indicators of petroleum hydrocarbon sources at the site. The key sampling results for these parameters are discussed individually below.

Benzene. The maximum concentrations of benzene reported for the February-July 1998 vapor well sampling are shown on Figure 5-8. Benzene concentrations >1,000 ppbv occur at wells MP-02 (maximum 64,000 ppbv), VW-51, VW-04, VW-45, VW-48, and VW-18. For reference, the ITSL for benzene is 100 ppbv for site and building boundary locations. Benzene exceeded the building boundary screening level at five locations (wells VW-45, VW-18, VW-51, MP-01, and MP-02). No exceedances of the site boundary screening level for benzene were observed during the February-July 1998 monitoring period. The sampling results indicate that the elevated benzene concentrations occur primarily in the areas of buried sump waste west-northwest and east of the WDI reservoir.

Toluene. The maximum concentrations of toluene reported for the February-July 1998 vapor well sampling are shown on Figure 5-9. Toluene concentrations >1,000 ppbv occur at wells VW-25 (maximum 4,700 ppbv) and MP-02. For reference, the ITSL for toluene is 10,600 ppbv for site and building boundary locations. Toluene did not exceed the site or building boundary screening level at any of the vapor wells sampled during the February-July 1998 monitoring period. The sampling results indicate that the elevated toluene concentrations occur primarily in localized areas of the buried sump waste (Area 5 and Area 7).

5.5 SOIL GAS CHARACTERISTICS AND SUBSURFACE DISTRIBUTION OF COCs

For this evaluation, six subsurface cross sections have been prepared to illustrate the vapor monitoring well network and soil gas conditions at the WDI site. The cross sections were selected to show the following information: (1) the depth and distribution of subsurface materials including the buried reservoir and waste sources/impacted soil zones outside of the reservoir; (2) the probe sampling intervals and soil gas results for the vapor monitoring wells; and (3) subsurface gas characteristics (field methane, oxygen, and carbon dioxide data). Figure 5-10 shows the locations of the vapor well cross sections. Representative results for February-July 1998 soil gas sampling (maximum detected concentrations of selected VOCs) and key subsurface features for the selected cross sections are discussed individually below.

Section A-A'. Figure 5-11a illustrates the soil gas VOC results for vapor wells located in the southwestern portion of the site, including the area of one of the 1998 SVE tests (Area 2). The highest concentrations of VOCs (primarily BTEX) were measured in wells VW-45 and VW-18. The VOC results for well VW-45 include the highest reported vinyl chloride concentration in vapor wells at the site (maximum 140,000 ppbv, October 1998 post-SVE sampling). The 1998 sampling has confirmed soil gas TCE concentrations on the order of 1,600 ppbv in the deep probe at perimeter well VW-35. Section A-A' is duplicated in Figure 5-11b to show representative (post-purging) methane, oxygen, and carbon dioxide composition of soil gas measured in the vapor wells.

Section B-B'. Figure 5-12a illustrates the soil gas VOC results for vapor wells located in the southern portion of the site (primarily Area 8). The VOC results indicate elevated levels of TCE, and moderate levels of PCE and vinyl chloride, and low to nondetect levels of BTEX in soil gas sampled in the vapor wells in this area. The results for the long single-screen monitoring well VW-23 are consistent with the results obtained from separate short-length probes monitoring the same depth interval in multi-level well VW-53. Section B-B' is duplicated in Figure 5-12b to show representative methane, oxygen, and carbon dioxide composition of soil gas measured in the vapor wells.

Section C-C'. Figure 5-13 illustrates the soil gas VOC results for vapor wells located in the eastern portion of the site, including the area of one of the 1998 SVE tests (Area 5). The highest concentrations of VOCs (primarily BTEX) were measured in wells VW-51 and MP-02. Soil gas in shallow, intermediate and deep probes also contains elevated levels of PCE, TCE, and vinyl chloride. Section C-C' shows the inferred location and depth of buried containment berm and sump wastes/impacted soils in this area of the site.

Section D-D'. Figure 5-14 illustrates the soil gas VOC results for vapor wells located in the northern portion of the site, including the area of one of the 1998 SVE tests (RV storage lot). The highest concentrations of VOCs (primarily BTEX) were measured in well VW-48. Soil gas sampled from the intermediate and deep probes in wells VW-46 and VW-63 contains elevated levels of PCE.

Section E-E'. Figure 5-15 illustrates the soil gas VOC results for vapor wells located in the southwestern portion of the site (Areas 1 and 8). The VOC results indicate elevated levels of PCE, moderate levels of TCE, and low to nondetect levels of BTEX in soil gas sampled in vapor wells VW-49, VW-59, and VW-60. Elevated BTEX concentrations in soil gas were observed at wells VW-18 and VW-17 (February 1998 sampling). The boring logs drilled for these vapor wells and other investigations have not shown evidence of buried sump wastes in this area.

Section F-F'. Figure 5-16 illustrates the soil gas VOC results for vapor wells located in the southern portion of the site (Areas 8 and 7). The highest concentrations of TCE in soil gas detected outside of the buried reservoir have been measured in wells VW-58, VW-22, VW-57 and VW-53 (shallow, intermediate, and deep probes). The 1998 sampling has confirmed low to nondetect levels of BTEX in soil gas in these wells. Section F-F' also shows the elevated soil gas BTEX at well VW-25 associated with the area of buried waste/hydrocarbon-impacted soils in Area 7 (former disposal pit).

5.6 CONCLUSIONS

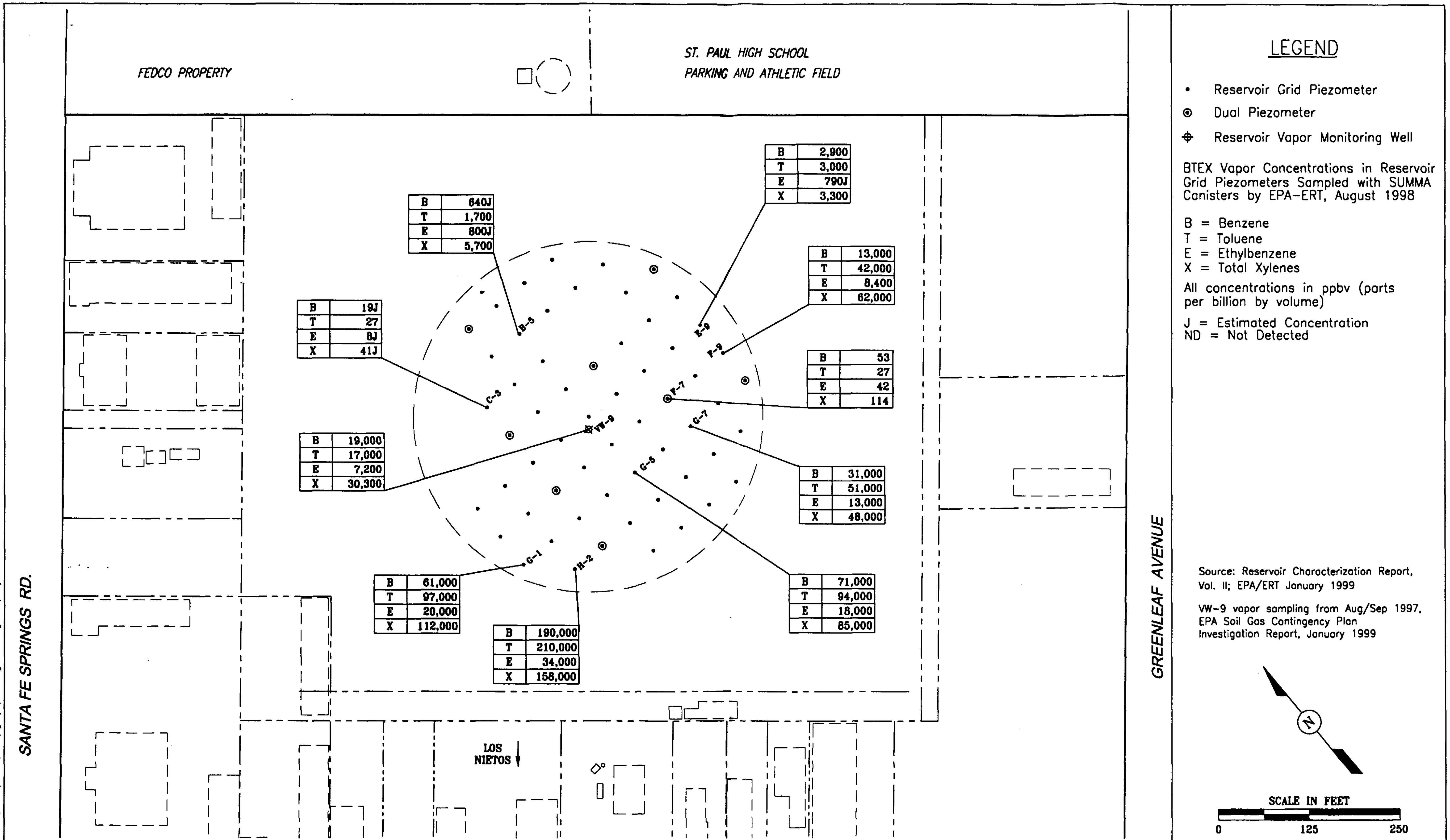
This evaluation of subsurface gas conditions at the WDI site is based on an extensive set of soil gas/vapor sampling and monitoring data from a variety of site investigations conducted since 1989. The evaluation focused primarily on the more recent sampling data collected during 1997-1998 from the current network of over 60 vapor monitoring wells. The following conclusions are made:

- A total of 48 chemicals were detected in the 1997-1998 soil gas sampling activities. Of these 48 chemicals, an estimated 16 chemicals have been identified as potential COCs. The primary COCs present in subsurface gas include BTEX, methane, and solvent-related VOCs, primarily TCE, PCE, and vinyl chloride. Overall, the distribution of soil gas COCs is variable across the site reflecting the composition and degradation of waste sources in the subsurface. Analyses of vapor samples from inside the buried reservoir confirm very high concentrations (typically 10,000 to 100,000 ppbv) of all of the soil gas COCs.

- Outside of the reservoir, methane and BTEX in soil gas occur primarily in the areas of buried wastes (chiefly drilling muds and petroleum-related wastes). During the monitoring period reviewed, these COCs were detected in vapor monitoring wells outside of the reservoir at the following maximum concentrations: methane 76%, benzene 64,000 ppbv, toluene 4,700 ppbv, and total xylenes 6,400 ppbv. Chlorinated solvent VOCs (TCE and PCE) and their degradation compounds (vinyl chloride and 1,2-dichloroethene) appear to be distributed in localized areas, including within the reservoir and in approximately five areas outside of the reservoir adjacent to, or underneath, on-site buildings (see Figure 5-17). During the monitoring period reviewed, chlorinated VOCs were detected in vapor wells outside of the reservoir at the following maximum concentrations: vinyl chloride 6,500 ppbv, TCE 3,900 ppbv, and PCE 1,400 ppbv.

- Quarterly monitoring of vapor monitoring wells in the interior area of the site indicate several localized soil gas areas of concern where vinyl chloride, benzene, TCE, and methane concentrations in soil gas consistently exceed interim screening threshold levels. Figure 5-17 shows the location of the soil gas areas of concern defined in the February-July 1998 vapor well sampling. The areas of concern include portions of the unlined sump areas immediately northwest, west, and east of the concrete-lined reservoir. Additional soil gas areas of concern are confirmed in the vadose zone (to depths of approximately 30 feet bgs) in the areas along the boundary of buried waste south of the reservoir (Area 8). A summary of site locations where the ITSLs have been exceeded in the interior vapor monitoring wells is presented in Table 5-2.

- Quarterly monitoring of the vapor monitoring well network during 1998 does not indicate widespread or significant migration of soil gas COCs beyond the WDI site boundary. To date, only local exceedances of the interim screening threshold levels for methane and TCE have been confirmed at perimeter monitoring wells. A summary of site locations where the ITSLs have been exceeded in the perimeter monitoring wells is presented in Table 5-2. During the monitoring period reviewed, no trends of increasing concentrations of soil gas COCs have been observed at the site perimeter.



CDM Federal Programs Corporation
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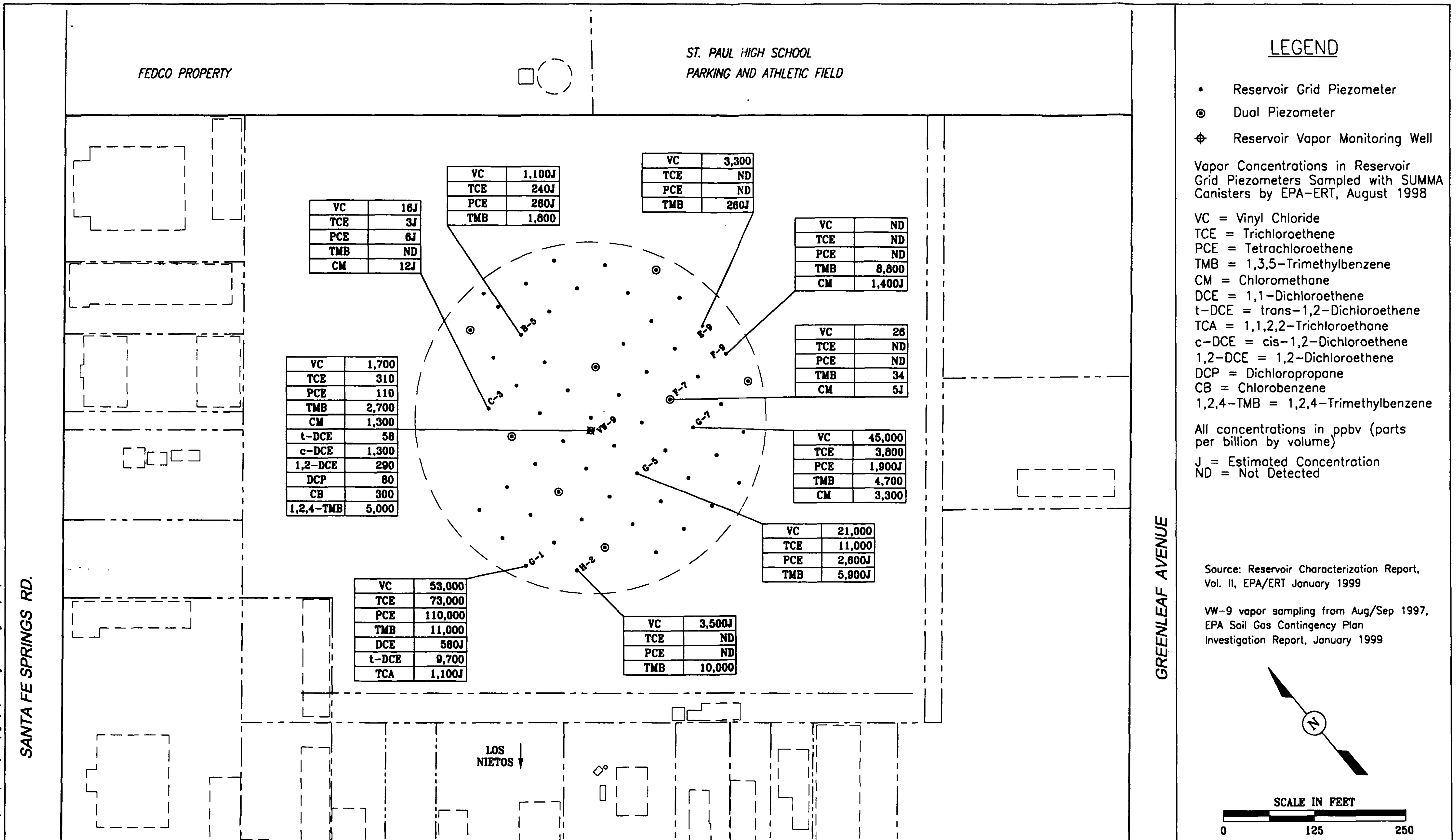
1998 VAPOR SAMPLING OF RESERVOIR PIEZOMETERS: BTEX COMPOUNDS
WASTE DISPOSAL INC., SANTA FE SPRINGS, CA

Figure 5-1



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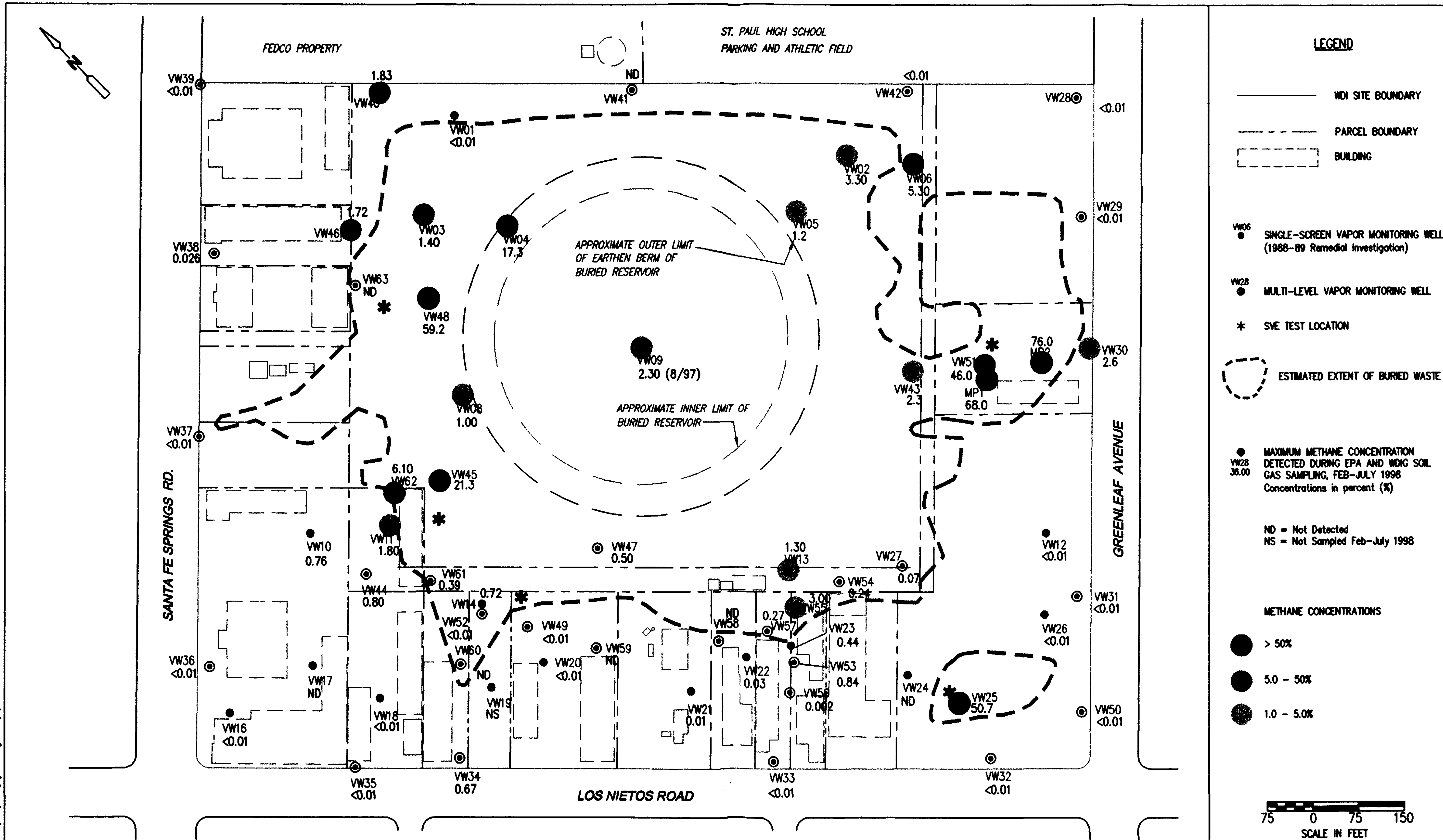
1998 VAPOR SAMPLING OF RESERVOIR PIEZOMETERS: CHLORINATED VOCs
WASTE DISPOSAL INC., SANTA FE SPRINGS, CA

Figure 5-2



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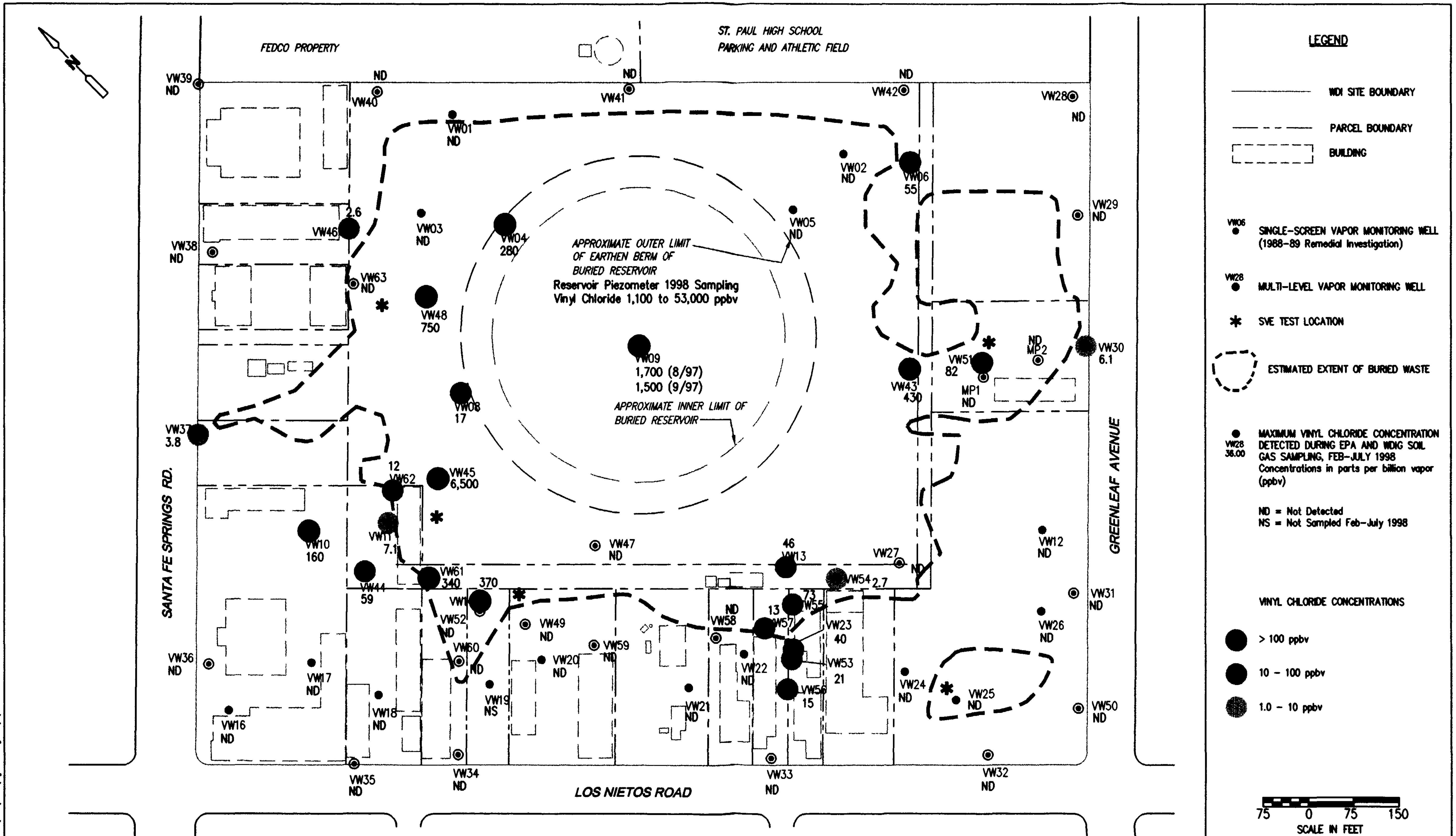
METHANE CONCENTRATION IN SOIL GAS; MAXIMUM DETECTED 1998
WASTE DISPOSAL INC.
SANTA FE SPRINGS, CALIFORNIA

Figure 5-3
Methane



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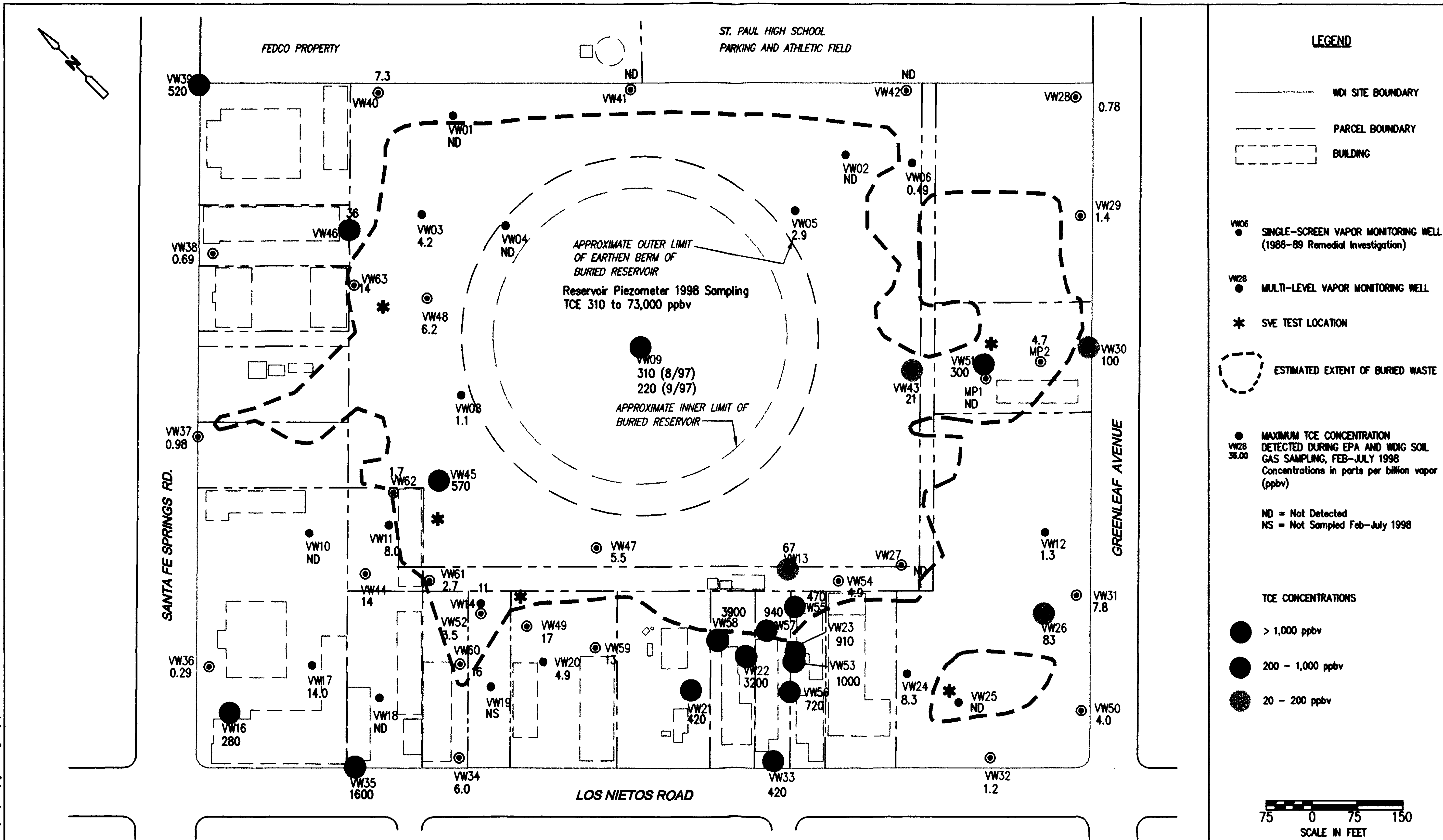
VINYL CHLORIDE CONCENTRATION IN SOIL GAS, MAXIMUM DETECTED 1998
WASTE DISPOSAL INC.
SANTA FE SPRINGS, CALIFORNIA

Figure 5-4
Vinyl Chloride



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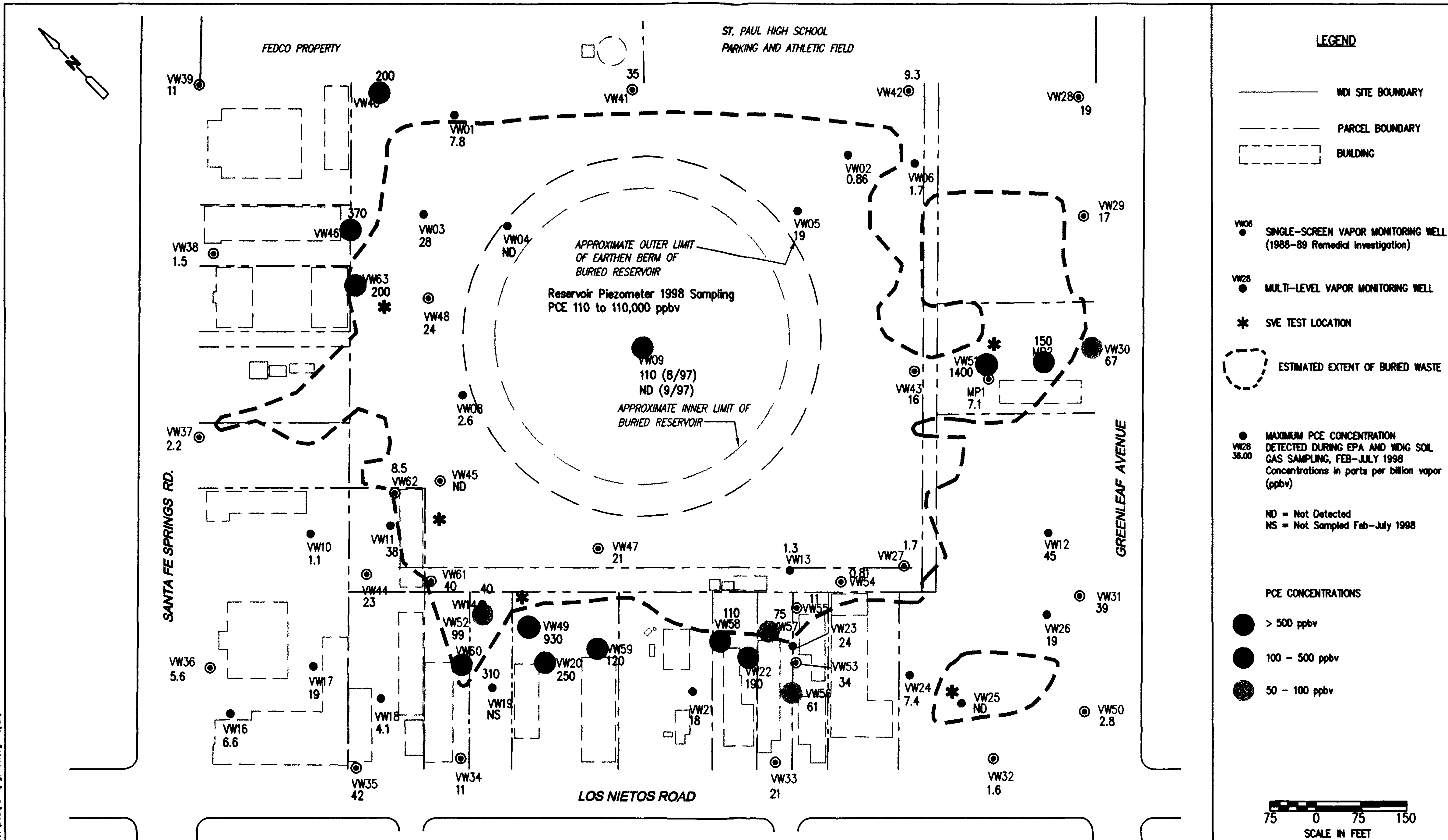
TCE CONCENTRATION IN SOIL GAS, MAXIMUM DETECTED 1998
WASTE DISPOSAL INC.
SANTA FE SPRINGS, CALIFORNIA

Figure 5-5
TCE



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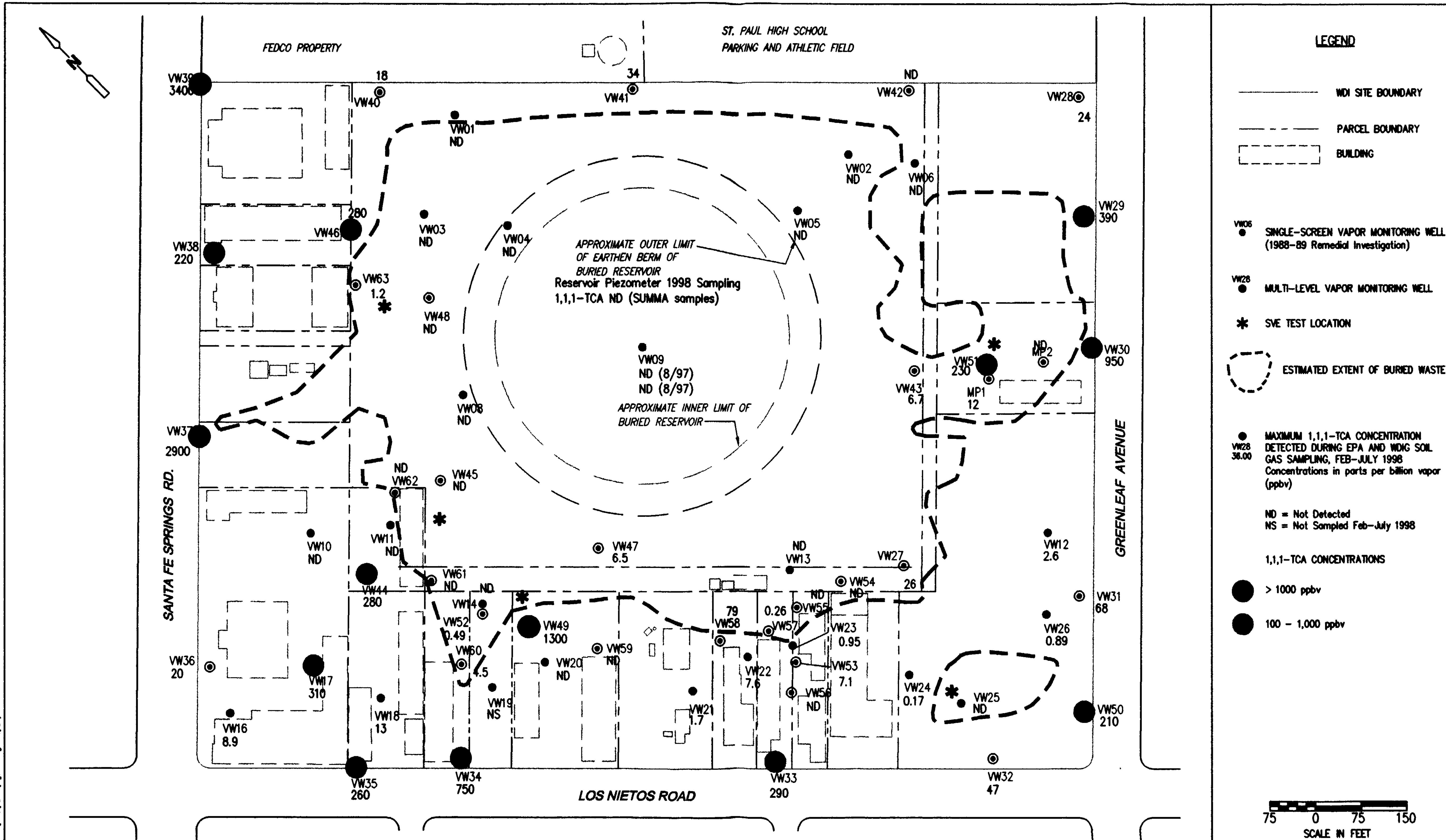
PCE CONCENTRATION IN SOIL GAS, MAXIMUM DETECTED 1998
WASTE DISPOSAL INC.
SANTA FE SPRINGS, CALIFORNIA

Figure 5-6
PCE



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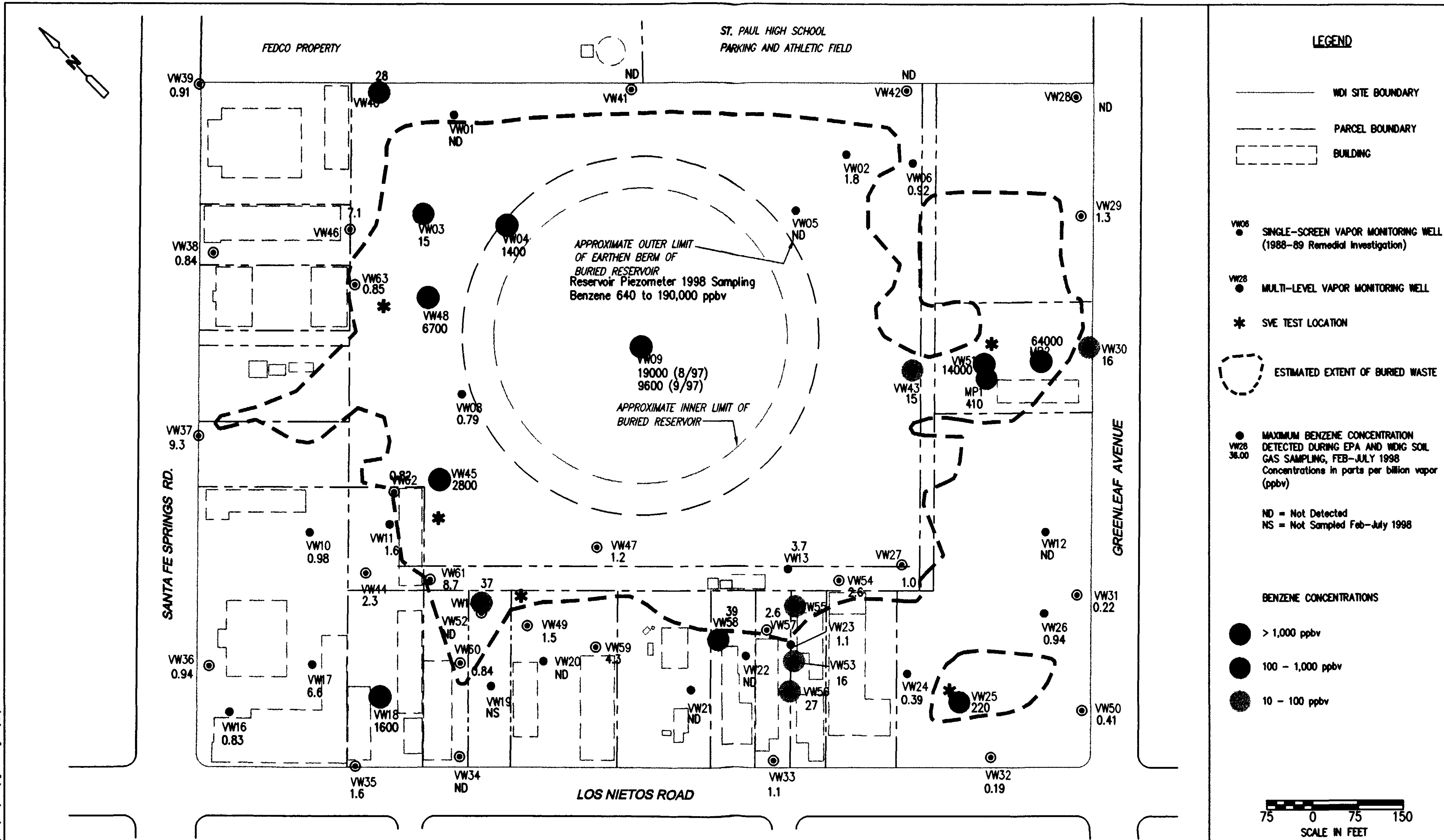
1,1,1-TCA CONCENTRATION IN SOIL GAS, MAXIMUM DETECTED 1998
WASTE DISPOSAL INC.
SANTA FE SPRINGS, CALIFORNIA

Figure 5-7
1,1,1-TCA



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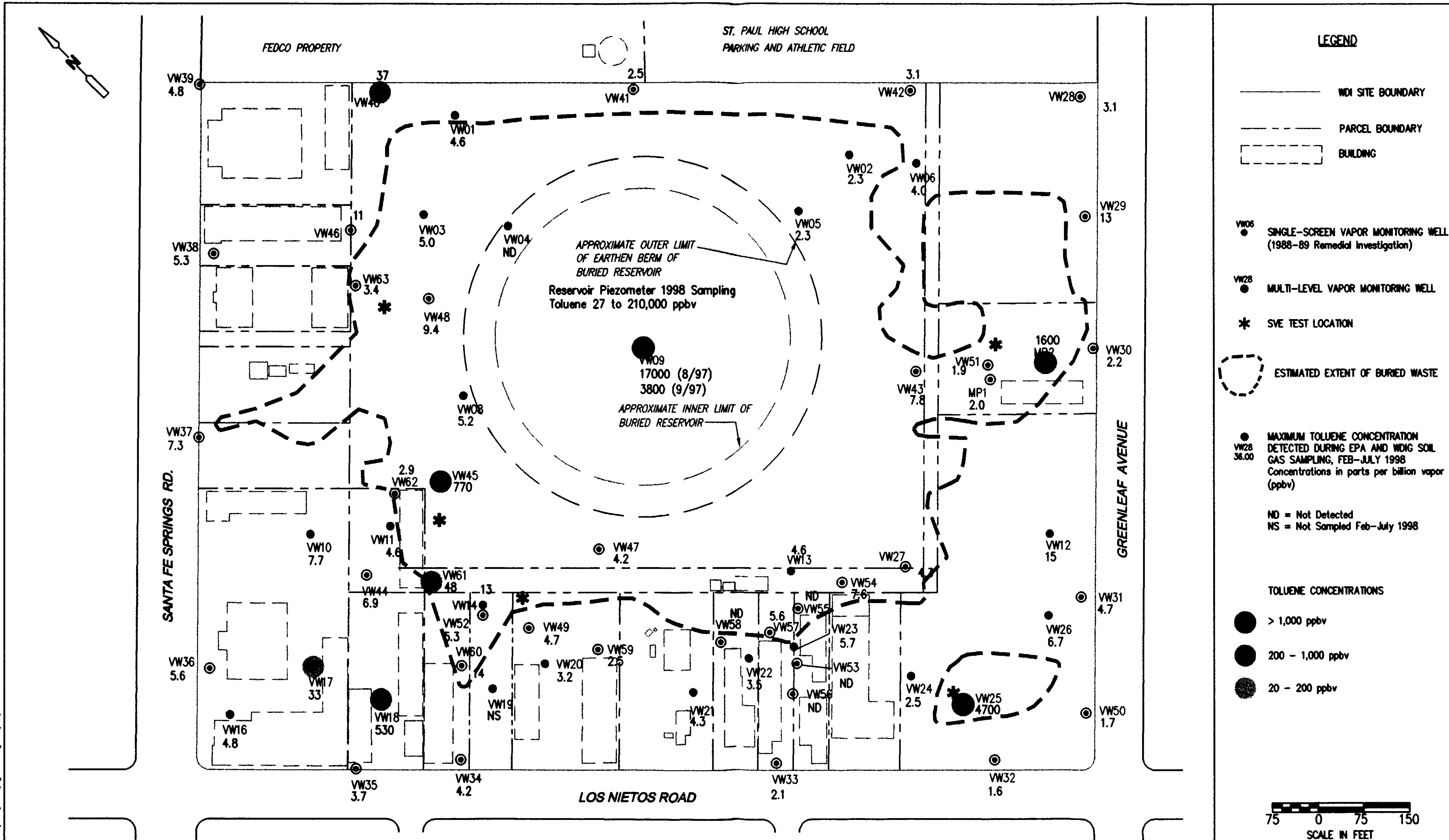
BENZENE CONCENTRATION IN SOIL GAS, MAXIMUM DETECTED 1998
WASTE DISPOSAL INC.
SANTA FE SPRINGS, CALIFORNIA

Figure 5-8
Benzene



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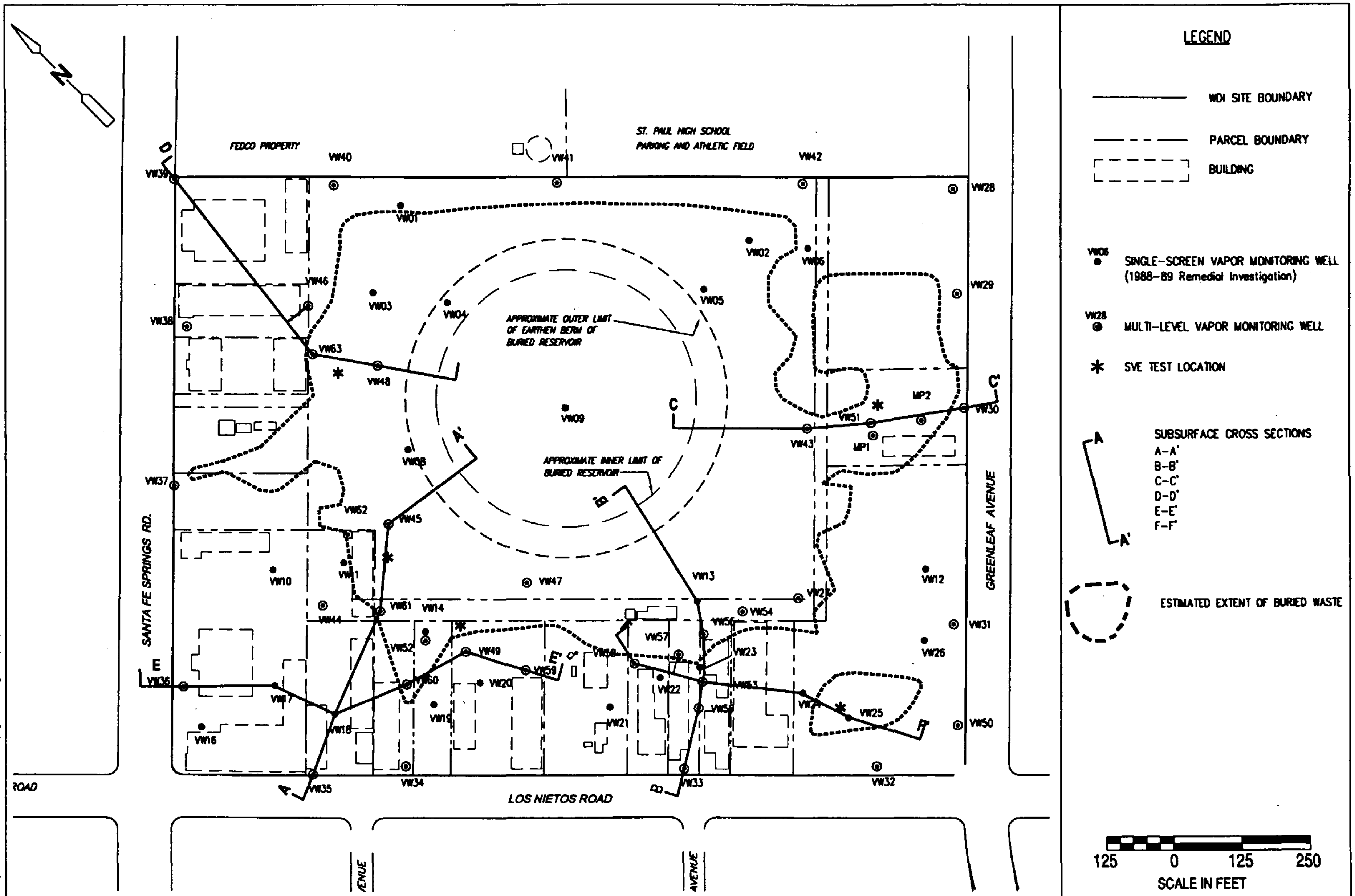
TOLUENE CONCENTRATION IN SOIL GAS, MAXIMUM DETECTED 1998
WASTE DISPOSAL INC.
SANTA FE SPRINGS, CALIFORNIA

Figure 5-9
Toluene



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LOCATION OF VAPOR MONITORING WELL CROSS SECTIONS
WASTE DISPOSAL INC.
SANTA FE SPRINGS, CALIFORNIA

Figure 5-10

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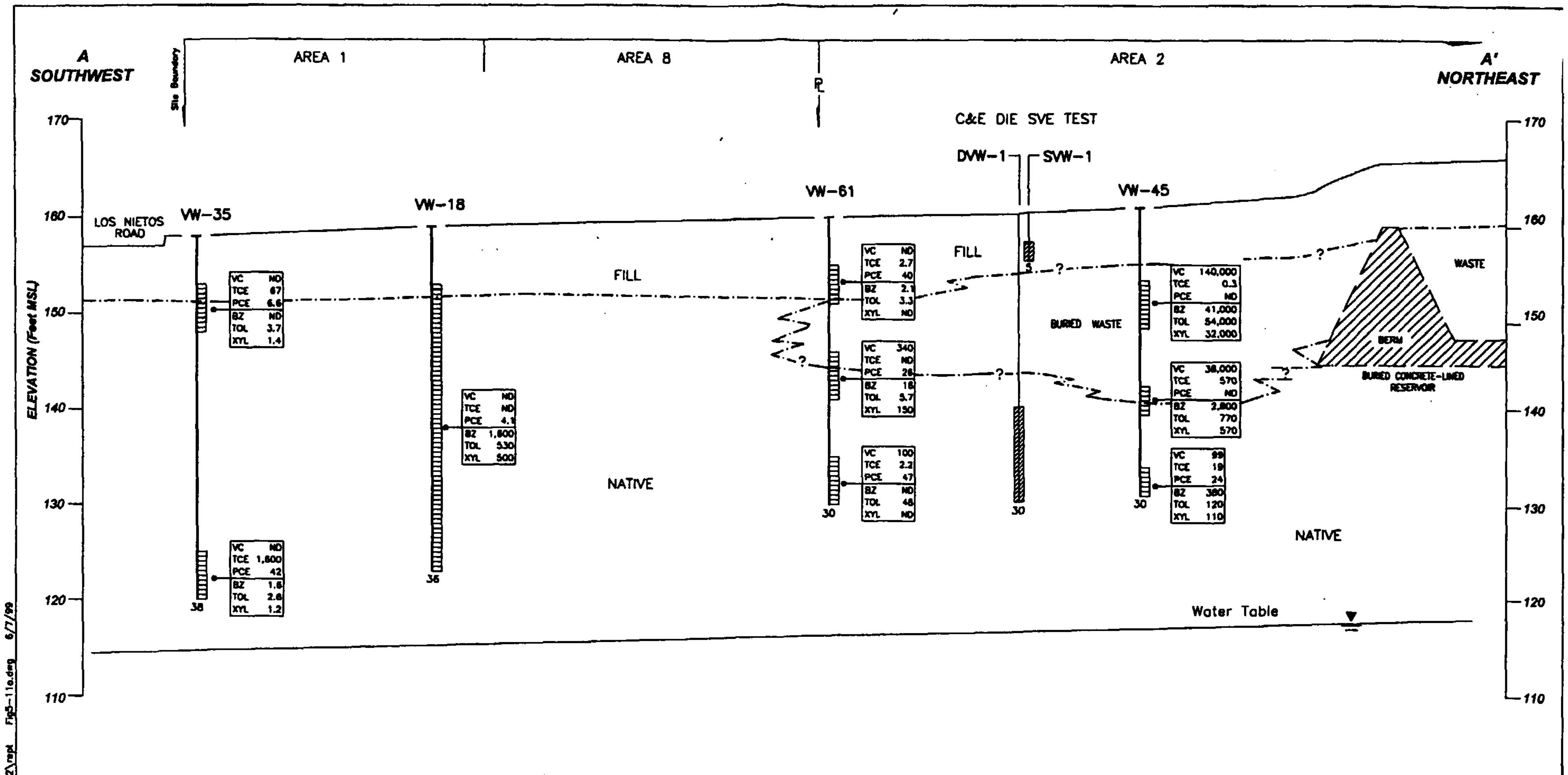


5 x Vertical Exaggeration

Horizontal Scale (ft.) 25 0 50

Vertical Scale (ft.) 5 0 10

Vapor Monitoring Well

Ground Surface

Screened portion of well

Total depth (ft. bgs) 30

Maximum Concentrations of Selected VOCs, Feb–July 1998 sampling

VC	Vinyl Chloride
TCE	Trichloroethene
PCE	Tetrachloroethene
BZ	Benzene
TOL	Toluene
XYL	Total Xylenes

All concentrations in parts per billion by volume (ppbv)

NOTE: Maximum concentrations listed for VW-45 and VW-61 include Oct 1998 sampling results (post-SVE test).

CDM Federal Programs Corporation

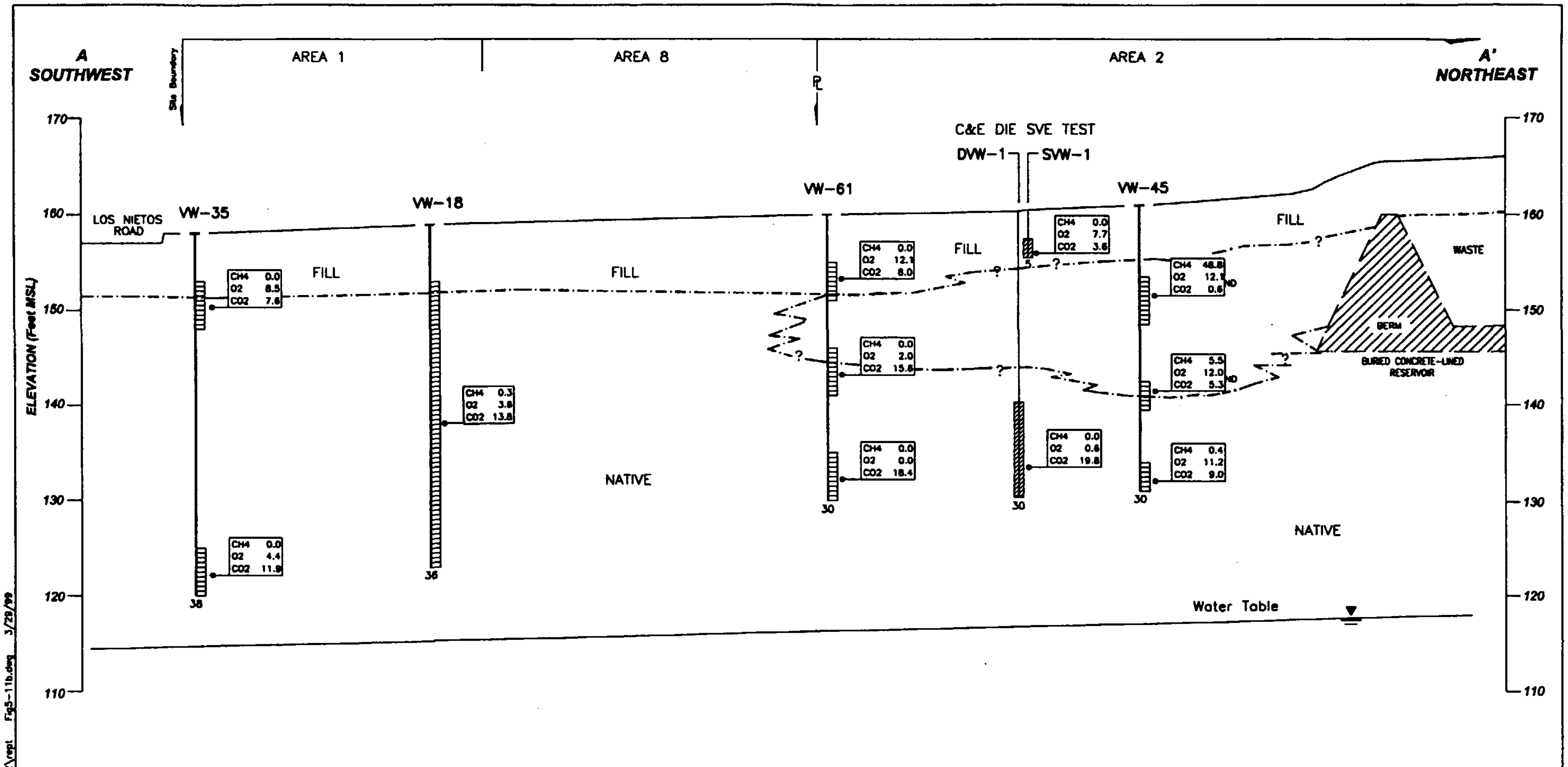
A Subsidiary of Camp Dresser & McKee Inc.

Figure 5-11a

Soil Gas VOC Concentrations Section A-A'

Subsurface Gas Evaluation Report
Waste Disposal, Inc.
Santa Fe Springs, California

c:\cadd\6118\006\sg2\rept Fig5-11a.dwg 6/7/99



5 x Vertical Exaggeration

Horizontal Scale (ft.)
25 0 50

Vertical Scale (ft.)
5 0 10

Vapor Monitoring Well

Ground Surface

Screened portion of well

Total depth (ft. bgs) 50

Soil Gas Parameters (stabilized after purging)
WDIG field measurements Oct. 1998 monitoring and testing

CH4	Methane	All concentrations in percent (%)
O2	Oxygen	
CO2	Carbon Dioxide	

CDM Federal Programs Corporation
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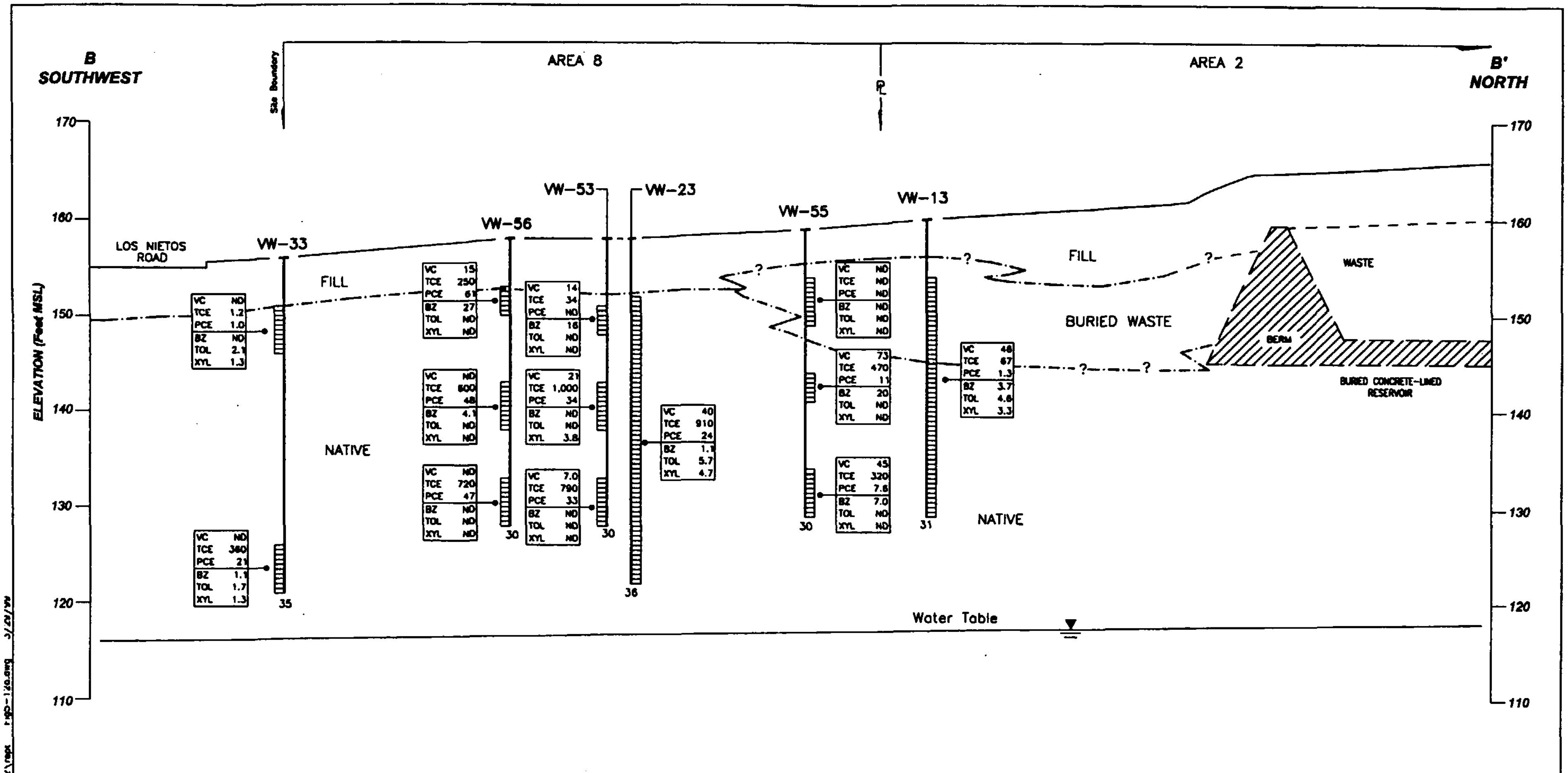
Figure 5-11b

Soil Gas Parameters Section A-A'

Subsurface Gas Evaluation Report
Waste Disposal, Inc.
Santa Fe Springs, California

c:\cadd\6118\008\sg2\rept Fig5-11b.dwg 3/29/99



5 x Vertical Exaggeration

Horizontal Scale (ft.) 25 0 50

Vertical Scale (ft.) 5 0 10

CDM Federal Programs Corporation
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Vapor Monitoring Well

Ground Surface

Screened portion of well

Total depth (ft. bgs) 30

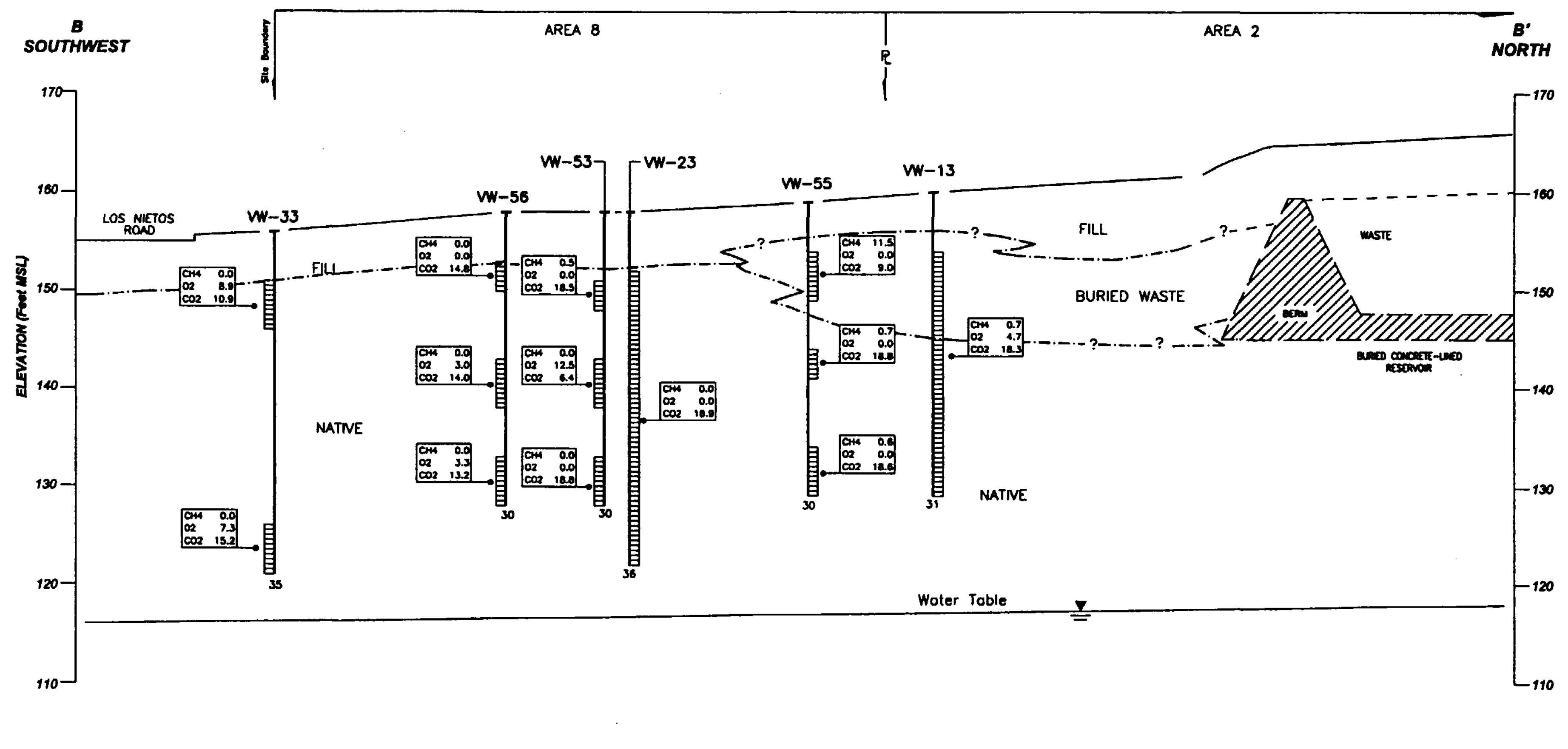
Maximum Concentrations of Selected VOCs, Feb–July 1998 sampling

VC	Vinyl Chloride	All concentrations in parts per billion by volume (ppbv)
TCE	Trichloroethene	
PCE	Tetrachloroethene	
BZ	Benzene	
TOL	Toluene	
XYL	Total Xylenes	

Figure 5-12a

Soil Gas VOC Concentrations
Section B-B'

Subsurface Gas Evaluation Report
Waste Disposal, Inc.
Santa Fe Springs, California



5 x Vertical Exaggeration

Horizontal Scale (ft.) 25 0 50

Vertical Scale (ft.) 5 0 10

CDM Federal Programs Corporation
A Subsidiary of Camp Dresser & McKee Inc.

Vapor Monitoring Well

Ground Surface

Screened portion of well

Total depth (ft. bgs)

Soil Gas Parameters (stabilized after purging)
WDIG field measurements Oct. 1998 monitoring and testing

CH4	Methane
O2	Oxygen
CO2	Carbon Dioxide

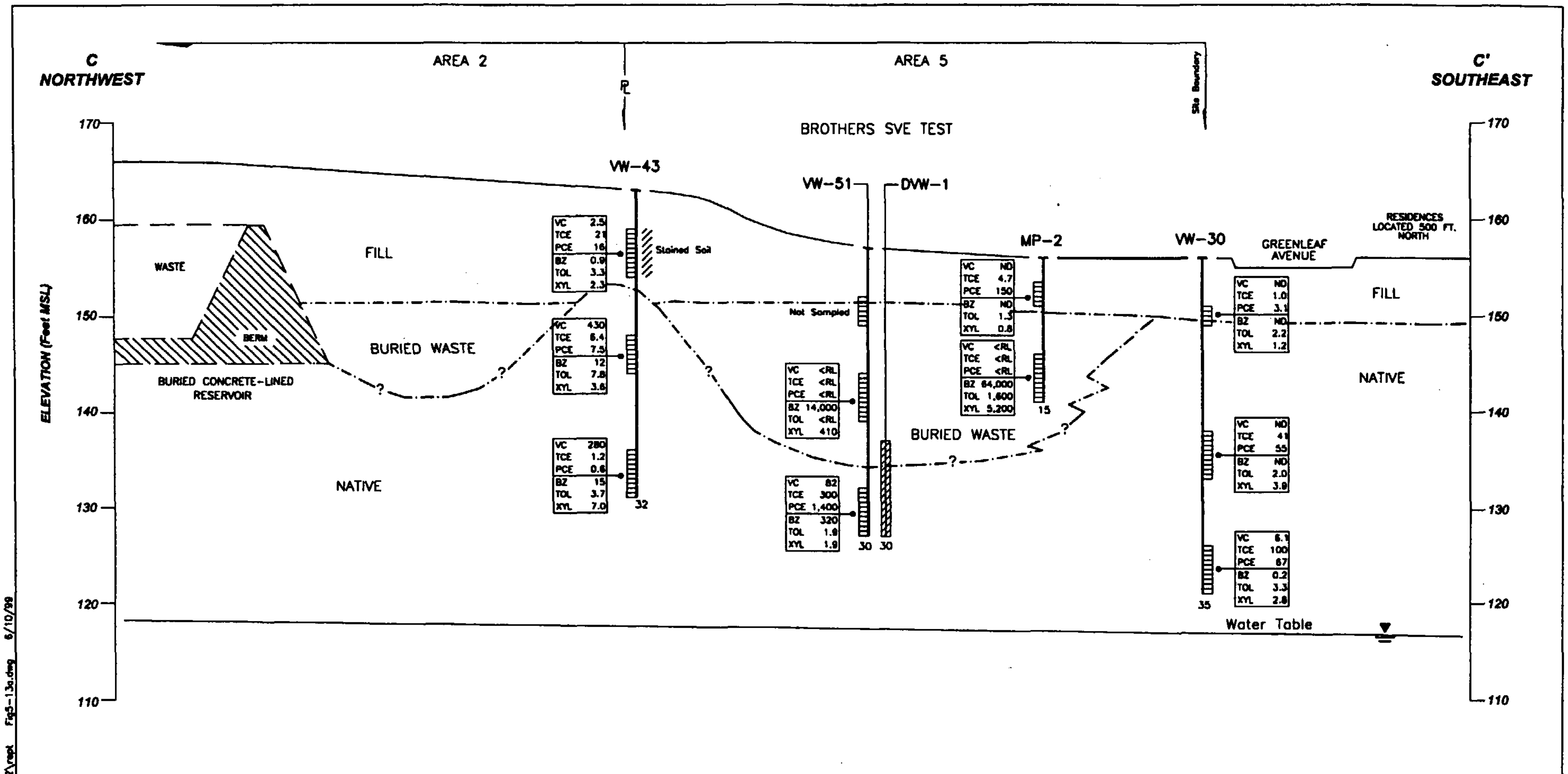
All concentrations in percent (%)

Figure 5-12b

Soil Gas Parameters
Section B-B'

Subsurface Gas Evaluation Report
Waste Disposal, Inc.
Santa Fe Springs, California

c:\cadd\6118\006\sg2\rept Fig5-12b.dwg 3/29/99



5 x Vertical Exaggeration

Horizontal Scale (ft.) 25 0 50

Vertical Scale (ft.) 5 0 10

Vapor Monitoring Well

Ground Surface

Screened portion of well

Total depth (ft. bgs) 30

Maximum Concentrations of Selected VOCs, Feb–July 1998 sampling

VC	Vinyl Chloride
TCE	Trichloroethene
PCE	Tetrachloroethene
BZ	Benzene
TOL	Toluene
XYL	Total Xylenes

All concentrations in parts per billion by volume (ppbv)
RL = Reporting Limit

CDM Federal Programs Corporation
A Subsidiary of Camp Dresser & McKee Inc.

Figure 5-13
Soil Gas VOC Concentrations
Section C-C'

Subsurface Gas Evaluation Report
Waste Disposal, Inc.
Santa Fe Springs, California

c:\cadd\6116\008\sg2\rept Fig5-13c.dwg 6/10/99

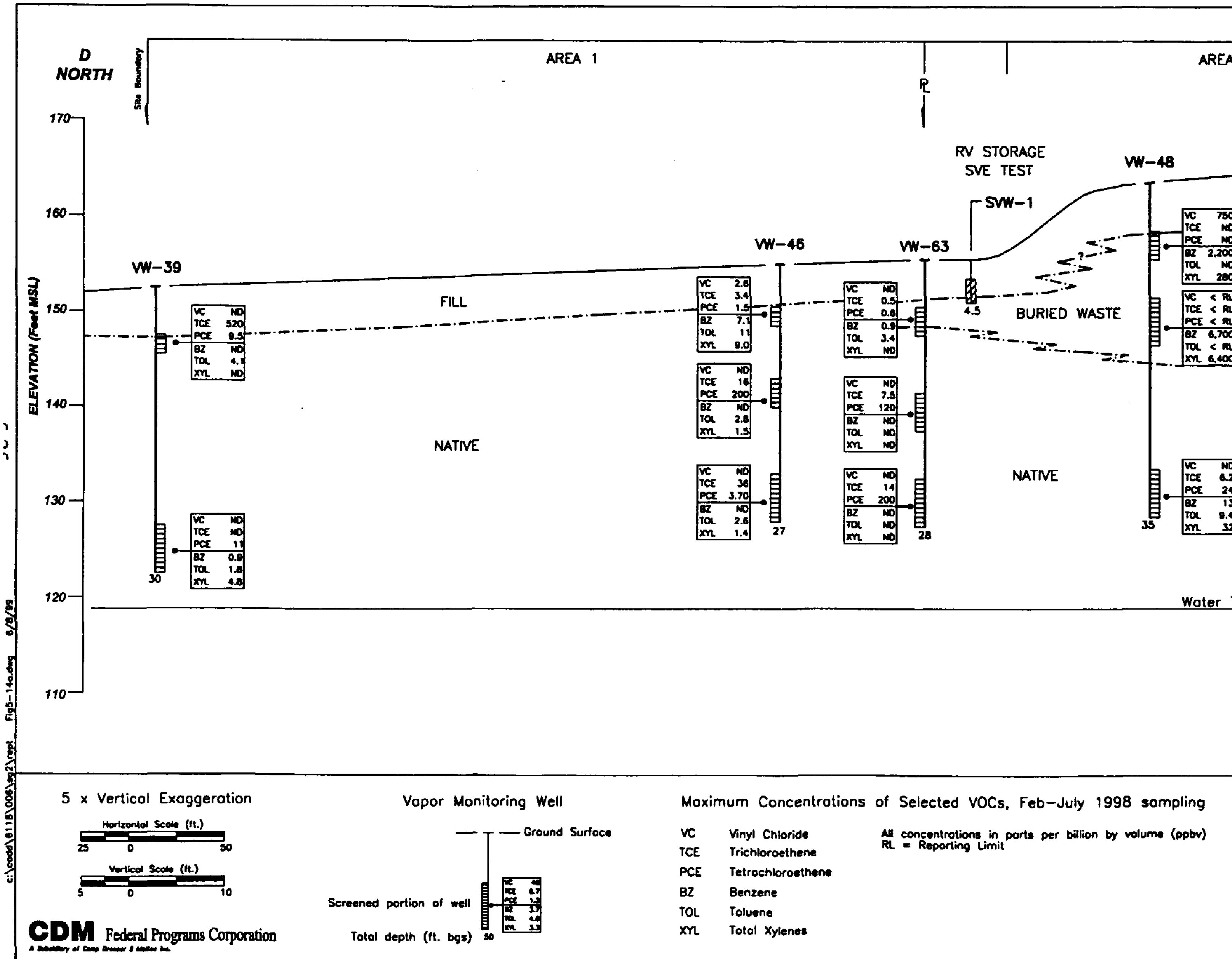
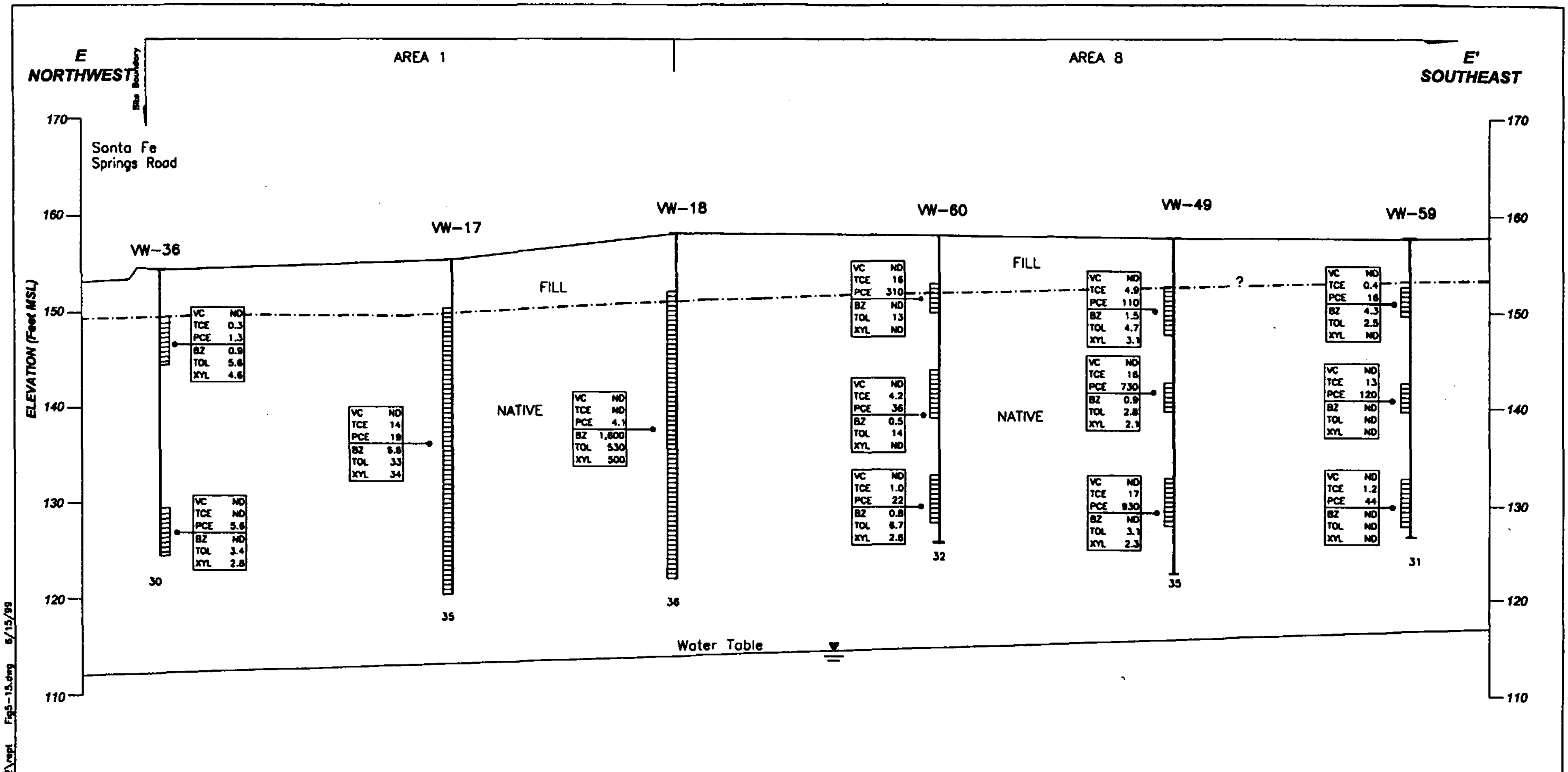


Figure 5-14

Soil Gas VOC Concentrations
Section D-D'

Subsurface Gas Evaluation Report
Waste Disposal, Inc.
Santa Fe Springs, California



5 x Vertical Exaggeration

Horizontal Scale (ft.) 25 0 50

Vertical Scale (ft.) 5 0 10

CDM Federal Programs Corporation

Vapor Monitoring Well

Ground Surface

Screened portion of well

Total depth (ft. bgs)

Maximum Concentrations of Selected VOCs, Feb–July 1998 sampling

All concentrations in parts per billion by volume (ppbv)

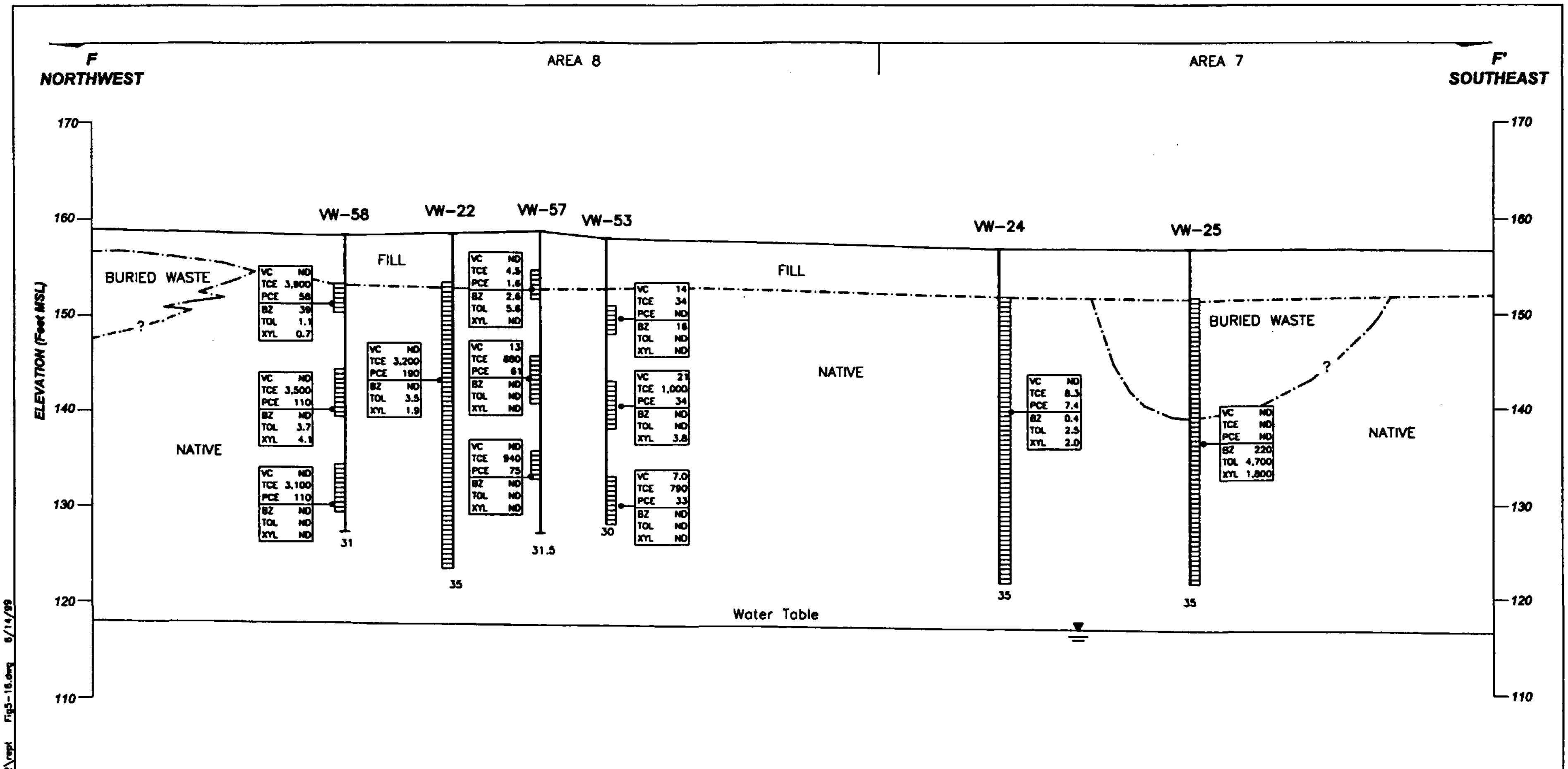
VC	Vinyl Chloride
TCE	Trichloroethene
PCE	Tetrachloroethene
BZ	Benzene
TOL	Toluene
XYL	Total Xylenes

Figure 5-15

Soil Gas VOC Concentrations Section E-E'

Subsurface Gas Evaluation Report
Waste Disposal, Inc.
Santa Fe Springs, California

c:\cadd\6118\006\sg2\repl Fig5-15.dwg 6/15/99



5 X Vertical Exaggeration

Horizontal Scale (ft.) 25 0 50

Vertical Scale (ft.) 5 0 10

Vapor Monitoring Well

Ground Surface

Screened portion of well

Total depth (ft. bgs) 30

Maximum Concentrations of Selected VOCs, Feb–July 1998 sampling

All concentrations in parts per billion by volume (ppbv)

VC	Vinyl Chloride
TCE	Trichloroethene
PCE	Tetrachloroethene
BZ	Benzene
TOL	Toluene
XYL	Total Xylenes

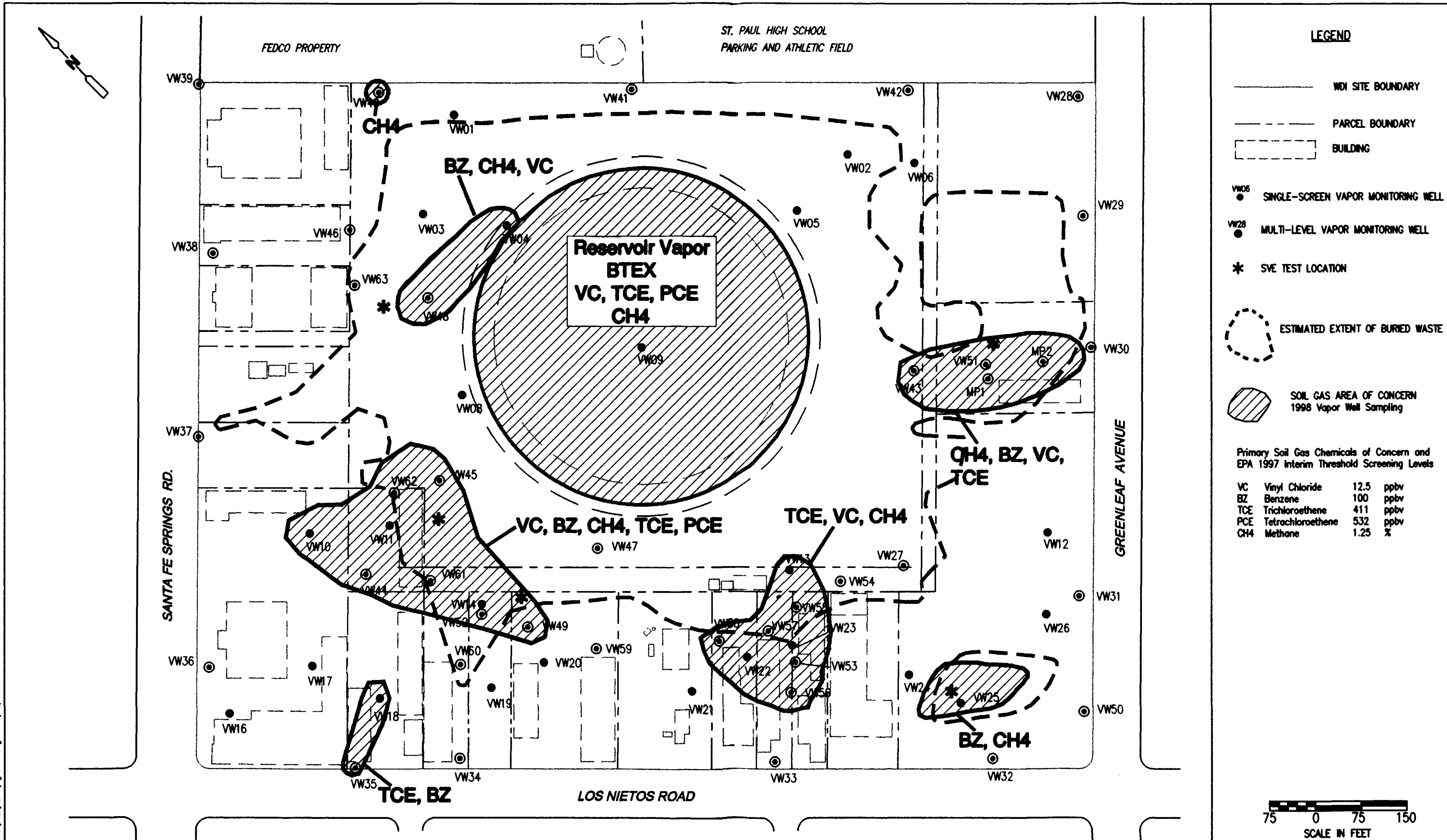
CDM Federal Programs Corporation
A Subsidiary of Camp Dresser & McKee Inc.

Figure 5-16

Soil Gas VOC Concentrations
Section F-F'

Subsurface Gas Evaluation Report
Waste Disposal, Inc.
Santa Fe Springs, California

c:\cadd\6118\006\sg2\rept Fig5-16.dwg 6/14/99



CDM Federal Programs Corporation
A Subsidiary of Camp Dresser & McKee Inc.

SOIL GAS AREAS OF CONCERN
WASTE DISPOSAL INC.
SANTA FE SPRINGS, CALIFORNIA

Figure 5-17

Table 5-1: Maximum Detected Concentrations of Selected Soil Gas Chemicals of Concern 1998 Sampling, WDI Vapor Monitoring Wells

Well / Probe Number		Vinyl Chloride	cis 1,2-DCE	TCE	PCE	1,1,1-TCA	Benzene	Toluene	m,p-Xylenes	Methane
	Boundary >>	12.5	930	411	532	18,400	100	10,600	7,140	1.250
	Sample Date	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	%
VW-01-035	Feb-98	ND	ND	ND	7.8	ND	ND	0.91	ND	< 0.001
	Apr-98	ND	ND	ND	6.0	ND	ND	ND	ND	< 0.001
	Jul-98	ND	ND	ND	7.4	ND	ND	4.6	1.2	< 0.001
VW-02-035	Feb-98	ND	ND	ND	ND	ND	ND	ND	1.5	3.300
	Apr-98	ND	ND	ND	ND	ND	1.8	ND	6.0	0.870
	Jul-98	ND	ND	ND	0.86	ND	ND	2.3	1.6	0.013
VW-03-035	Feb-98	ND	ND	ND	7.7	ND	15	5.0	4.3	1.400
	Apr-98	ND	ND	ND	28	ND	ND	ND	ND	NR
	Jul-98	ND	ND	4.2	26	ND	3.4	2.3	2.4	0.905
VW-04-023	Feb-98	ND	460	ND	ND	ND	830	ND	ND	13.000
	Apr-98	280	ND	ND	ND	ND	1,400	ND	ND	ND
	Jul-98	ND	ND	ND	ND	ND	890	ND	ND	17.300
VW-05-029	Feb-98	ND	0.85	2.7	17	ND	ND	ND	0.82	1.200
	Apr-98	ND	ND	0.65	16	ND	ND	ND	ND	0.054
	Jul-98	ND	ND	2.9	19	ND	ND	2.3	1.3	ND
VW-06-034	Feb-98	55	ND	ND	ND	ND	ND	ND	ND	5.300
	Apr-98	3.3	ND	0.49	1.1	ND	ND	ND	ND	0.240
	Jul-98	ND	ND	ND	1.7	ND	0.92	4.0	2.8	0.130
VW-08-035	Feb-98	4.6	ND	ND	1.6	ND	0.79	0.92	ND	0.860
	Apr-98	17	ND	ND	ND	ND	ND	ND	ND	1.000
	Jul-98	ND	ND	1.1	2.6	ND	ND	5.2	3.1	< 0.001
VW-09-023	Aug-97	1,700	1,300	310	110	ND	19,000	17,000	23,000	2.300
VW-10-035	Feb-98	150	83	ND	0.82	ND	0.98	1.3	ND	0.560
	Apr-98	120	90	ND	ND	ND	ND	ND	ND	0.670
	Jul-98	160	110	ND	1.1	ND	ND	7.7	3.8	0.706
VW-11-035	Feb-98	7.1	1.9	8.0	38	ND	1.6	1.5	ND	1.800
	Apr-98	5.6	2.6	3.9	16	ND	1.5	2.5	1.3	1.500
	Jul-98	6.6	ND	ND	3.4	ND	ND	4.6	2.1	1.510
VW-12-034	Feb-98	ND	ND	1.3	38	ND	ND	1.6	0.76	< 0.001
	Apr-98	ND	ND	1.2	45	ND	ND	2.0	ND	< 0.001
	Jul-98	ND	ND	1.3	28	2.6	ND	15	4.9	ND
VW-13-031	Feb-98	29	50	62	ND	ND	2.6	ND	ND	1.300
	Apr-98	46	69	67	0.95	ND	3.6	1.9	1.6	NR
	Jul-98	37	52	66	1.3	ND	3.7	4.6	3.3	0.750
VW-14-035	Feb-98	370	41	11	20	ND	37	13	620	0.720
	Apr-98	350	ND	ND	ND	ND	ND	ND	1,300	NR
	Jul-98	ND	ND	ND	40	ND	ND	ND	530	0.011
VW-16-034	Feb-98	ND	ND	91	1.9	6.2	ND	1.1	ND	ND
	Apr-98	ND	ND	280	5.0	8.9	ND	ND	ND	ND
	Jul-98	ND	ND	270	6.6	8.4	0.83	4.8	2.0	< 0.001
VW-17-035	Feb-98	ND	2.2	14	19	240	6.6	33	34	ND
	Apr-98	ND	ND	8.9	13	240	ND	ND	ND	ND
	Jul-98	ND	ND	9.1	14	310	ND	6.0	3.9	ND
VW-18-036	Feb-98	ND	ND	ND	ND	ND	1,600	530	350	< 0.001
	Apr-98	ND	ND	ND	ND	ND	470	190	500	< 0.001
	Jul-98	ND	ND	ND	4.1	13	110	6.4	190	< 0.001
VW-20-035	Feb-98	ND	ND	3.9	150	ND	ND	1.3	0.7	ND
	Apr-98	ND	ND	4.9	250	ND	ND	ND	ND	ND
	Jul-98	ND	ND	3.4	100	ND	ND	3.2	2.6	< 0.001

Table 5-1: Maximum Detected Concentrations of Selected Soil Gas Chemicals of Concern 1998 Sampling, WDI Vapor Monitoring Wells

Well / Probe Number		Vinyl Chloride	cis 1,2-DCE	TCE	PCE	1,1,1-TCA	Benzene	Toluene	m,p-Xylenes	Methane
	Boundary >>	12.5	930	411	532	18,400	100	10,600	7,140	1.250
	Sample Date	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	%
VW-21-036	Feb-98	ND	6.7	420	18	1.7	ND	1.1	ND	< 0.001
	Apr-98	ND	ND	360	17	ND	ND	ND	ND	< 0.001
	Jul-98	ND	1.1	350	17	1.7	ND	4.3	3.3	0.012
VW-22-035	Feb-98	ND	ND	1,400	130	7.6	ND	ND	ND	< 0.001
	Apr-98	ND	ND	3,200	190	ND	ND	ND	ND	0.034
	Jul-98	ND	5.6	850	83	5.3	ND	3.5	1.9	0.008
VW-23-036	Feb-98	35	130	910	22	0.91	1.1	1.2	0.66	0.420
	Apr-98	40	130	850	23	ND	ND	ND	ND	0.440
	Jul-98	26	130	690	24	0.95	1.1	5.7	4.7	0.210
VW-24-035	Feb-98	ND	ND	6.6	7.3	0.17	0.39	1.4	1.2	ND
	Apr-98	ND	ND	8.3	6.8	ND	ND	ND	ND	ND
	Jul-98	ND	ND	4.4	7.4	ND	ND	2.5	2.0	ND
VW-25-035	Feb-98	ND	ND	ND	ND	ND	220	4,700	1,800	50.700
	Apr-98	ND	ND	ND	ND	ND	ND	ND	ND	NR
	Jul-98	ND	ND	ND	ND	ND	ND	ND	ND	0.530
VW-26-035	Feb-98	ND	110	83	19	0.89	ND	0.56	0.33	< 0.001
	Jul-98	ND	47	33	13	0.71	0.94	6.7	5.4	< 0.001
VW-27-009	Apr-98	ND	ND	ND	ND	4.9	ND	ND	ND	0.070
	Jul-98	ND	ND	ND	ND	4.2	ND	1.9	1.2	< 0.001
VW-27-019	Feb-98	ND	ND	ND	1.0	22	1.0	4.3	3.2	< 0.001
	Apr-98	ND	ND	ND	1.7	26	ND	1.6	0.88	< 0.001
VW-27-033	Feb-98	ND	ND	ND	1.0	ND	ND	2.3	1.9	ND
	Apr-98	ND	ND	ND	0.72	ND	ND	ND	ND	ND
VW-28-010	Jul-98	ND	ND	0.78	7.3	24	ND	3.1	2.4	< 0.001
VW-28-025	Jul-98	ND	ND	ND	19	0.62	ND	2.4	1.8	ND
VW-29-010	Feb-98	ND	ND	ND	1.2	20	1.3	8.5	5.9	< 0.001
	Apr-98	ND	ND	ND	1.5	390	ND	1.1	0.84	< 0.001
	Jul-98	ND	ND	ND	1.9	48	ND	3.3	1.7	< 0.001
VW-29-023	Feb-98	ND	ND	ND	8.0	1.2	0.52	9.5	4.1	ND
	Apr-98	ND	ND	ND	7.1	5.1	ND	1.1	0.58	ND
	Jul-98	ND	ND	ND	4.8	ND	ND	2.4	1.1	ND
VW-29-035	Feb-98	ND	ND	0.50	16	0.75	0.44	13	3.4	ND
	Apr-98	ND	ND	1.4	17	2.6	ND	0.94	ND	ND
	Jul-98	ND	ND	ND	11	ND	ND	2.6	1.4	< 0.001
VW-30-007	Feb-98	ND	ND	ND	ND	950	ND	ND	ND	< 0.001
	Jul-98	ND	ND	1.0	3.1	360	ND	2.2	1.2	0.010
VW-30-023	Feb-98	ND	7.9	41	50	15	ND	ND	ND	2.300
	Jul-98	ND	4.0	10	55	1.9	ND	2.0	3.9	0.130
VW-30-035	Feb-98	6.1	40	100	67	7.7	16	ND	ND	2.600
	Jul-98	1.3	12	23	67	ND	ND	2.2	1.3	0.330
VW-31-010	Feb-98	ND	ND	0.45	17	68	ND	0.85	0.43	< 0.001
	Apr-98	ND	ND	ND	16	36	ND	1.1	0.68	< 0.001
	Jul-98	ND	ND	ND	16	2.0	ND	4.7	4.1	ND
VW-31-030	Feb-98	ND	ND	7.8	39	8.4	0.22	0.56	0.35	< 0.001
	Apr-98	ND	ND	6.0	35	6.7	ND	ND	ND	< 0.001
	Jul-98	ND	ND	4.9	32	0.55	ND	3.3	2.8	ND

Table 5-1: Maximum Detected Concentrations of Selected Soil Gas Chemicals of Concern
1998 Sampling, WDI Vapor Monitoring Wells

Well / Probe Number		Vinyl Chloride	cis 1,2-DCE	TCE	PCE	1,1,1-TCA	Benzene	Toluene	m,p-Xylenes	Methane
	Boundary >>	12.5	930	411	532	18,400	100	10,600	7,140	1.250
	Sample Date	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	%
VW-32-008	Feb-98	ND	ND	0.29	1.5	28	ND	ND	ND	< 0.001
	Apr-98	ND	ND	ND	1.4	47	ND	0.75	ND	< 0.001
	Jul-98	ND	ND	0.94	0.72	9.4	ND	1.6	1.2	< 0.001
VW-32-018	Feb-98	ND	ND	0.55	1.6	12	ND	0.38	0.25	ND
	Apr-98	ND	ND	ND	1.1	8.4	ND	ND	0.67	ND
	Jul-98	ND	ND	ND	0.97	5.6	ND	1.2	0.93	ND
VW-32-035	Feb-98	ND	0.57	1.2	1.5	4.4	0.19	0.76	0.46	ND
	Apr-98	ND	ND	0.83	1.2	3.0	ND	ND	ND	ND
	Jul-98	ND	ND	0.65	1.0	2.8	ND	1.1	0.77	ND
VW-33-010	Feb-98	ND	ND	1.2	0.99	170	ND	0.94	0.57	< 0.001
	Apr-98	ND	ND	0.58	1.0	290	ND	0.65	ND	< 0.001
	Jul-98	ND	ND	0.94	1.5	120	ND	2.1	1.3	< 0.001
VW-33-035	Feb-98	ND	2.0	420	18	20	1.1	1.1	0.25	< 0.001
	Apr-98	ND	1.9	360	21	27	ND	ND	ND	< 0.001
	Jul-98	ND	ND	16	2.1	1.8	ND	1.7	1.3	< 0.001
VW-34-010	Feb-98	ND	ND	0.54	6.4	750	ND	4.2	3.4	< 0.001
	Apr-98	ND	ND	0.67	2.5	470	ND	0.67	0.66	< 0.001
	Jul-98	ND	ND	ND	2.3	130	ND	3.0	1.6	< 0.001
VW-34-023	Feb-98	ND	ND	ND	9.0	15	ND	3.3	2.4	< 0.001
	Apr-98	ND	ND	ND	11	4.9	ND	ND	ND	ND
	Jul-98	ND	ND	ND	9.2	4.7	ND	2.4	0.91	< 0.001
VW-34-040	Feb-98	ND	ND	5.6	5.9	9.0	ND	3.4	2.7	< 0.001
	Apr-98	ND	ND	6.0	8.0	2.5	ND	ND	0.9	< 0.001
	Jul-98	ND	ND	4.1	6.3	0.53	ND	2.7	1.4	< 0.001
VW-35-010	Feb-98	ND	ND	44	6.6	260	ND	ND	ND	< 0.001
	Apr-98	ND	ND	50	2.9	49	ND	ND	ND	< 0.001
	Jul-98	ND	ND	67	3.6	19	ND	3.7	1.4	< 0.001
VW-35-038	Feb-98	ND	ND	1,600	16	16	ND	ND	ND	< 0.001
	Apr-98	ND	ND	1,500	28	11	ND	ND	ND	< 0.001
	Jul-98	ND	ND	1,200	42	4.9	1.6	2.6	1.2	< 0.001
VW-36-010	Feb-98	ND	0.94	0.29	1.3	20	0.61	2.6	1.1	< 0.001
	Apr-98	ND	ND	ND	0.87	9.9	ND	0.69	ND	NR
	Jul-98	ND	ND	ND	1.3	3.1	0.94	5.6	4.6	< 0.001
VW-36-030	Feb-98	ND	ND	ND	5.6	1.1	ND	1.9	0.89	ND
	Apr-98	ND	ND	ND	2.1	ND	ND	ND	ND	NR
	Jul-98	ND	ND	ND	2.1	ND	ND	3.4	2.8	ND
VW-37-010	Feb-98	ND	ND	0.98	0.57	2,900	9.3	1.8	4.8	< 0.001
	Apr-98	ND	ND	ND	0.46	1,400	1.5	1.9	0.61	< 0.001
	Jul-98	ND	ND	ND	0.60	320	1.6	7.3	3.7	< 0.001
VW-37-030	Feb-98	ND	ND	0.89	1.9	41	ND	1.2	1.0	ND
	Apr-98	ND	ND	ND	2.2	9.9	ND	ND	ND	ND
	Jul-98	3.8	ND	0.98	1.4	1.9	0.84	2.7	4.8	0.095
VW-38-010	Feb-98	ND	ND	0.69	1.3	220	ND	1.5	2.7	0.002
	Apr-98	ND	ND	ND	1.2	120	ND	1.0	0.81	< 0.001
	Jul-98	ND	ND	ND	1.5	68	0.84	5.3	3.9	< 0.001
VW-38-034	Feb-98	ND	ND	ND	ND	69	ND	ND	ND	0.008
	Apr-98	ND	ND	ND	ND	12	ND	ND	ND	0.014
	Jul-98	ND	ND	ND	3.0	ND	ND	3.6	ND	0.026

Table 5-1: Maximum Detected Concentrations of Selected Soil Gas Chemicals of Concern 1998 Sampling, WDI Vapor Monitoring Wells

Well / Probe Number		Vinyl Chloride	cis 1,2-DCE	TCE	PCE	1,1,1-TCA	Benzene	Toluene	m,p-Xylenes	Methane
	Boundary >>	12.5	930	411	532	18,400	100	10,600	7,140	1.250
	Sample Date	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	%
VW-39-007	Feb-98	ND	ND	520	ND	3,400	ND	ND	ND	< 0.001
	Apr-98	ND	ND	ND	6.8	640	ND	ND	ND	ND
	Jul-98	ND	ND	ND	9.5	240	ND	4.1	ND	< 0.001
VW-39-030	Feb-98	ND	ND	ND	10	160	ND	0.77	1.1	
	Apr-98	ND	ND	ND	11	230	ND	1.8	ND	< 0.001
	Jul-98	ND	ND	ND	9.5	50	0.91	0.72	4.8	< 0.001
VW-40-010	Feb-98	ND	0.88	0.66	2.5	18	12	3.9	4.9	0.820
	Apr-98	ND	ND	1.2	2.7	17	18	2.7	2.7	1.500
	Jul-98	ND	1.9	1.1	3.9	18	28	4.1	4.6	1.830
VW-40-025	Feb-98	ND	ND	6.8	200	8.8	4.0	37	52	ND
	Apr-98	ND	ND	7.3	190	2.3	ND	ND	ND	ND
	Jul-98	ND	ND	4.6	150	2.1	ND	3.5	2.5	ND
VW-41-007	Apr-98	ND	ND	ND	35	34	ND	ND	ND	ND
	Jul-98	ND	ND	ND	34	23	ND	2.5	0.99	ND
VW-41-020	Apr-98	ND	ND	ND	16	22	ND	0.75	0.57	ND
	Jul-98	ND	ND	ND	14	15	ND	1.8	1.1	ND
VW-42-010	Jul-98	ND	ND	ND	6.2	ND	ND	3.1	2.3	< 0.001
VW-42-030	Jul-98	ND	ND	ND	9.3	ND	ND	2.9	2.3	ND
VW-43-009	Apr-98	2.5	6.5	21	15	3.2	0.90	0.92	ND	0.016
	Jul-98	ND	ND	3.8	16	6.7	ND	3.3	2.3	< 0.001
VW-43-019	Apr-98	430	98	6.4	7.5	3.2	12	5.6	2.8	NR
	Jul-98	240	71 ND	3.1	4.9	ND	12	7.8	3.6	2.200
VW-43-032	Apr-98	230	190	1.2	0.57	ND	15	1.8	7.0	NR
	Jul-98	280	180	ND	ND	ND	11	3.7	4.6	2.300
VW-44-007	Feb-98	ND	3.0	14	23	280	ND	ND	19	0.003
	Apr-98	ND	ND	1.1	ND	51	2.3	5.7	1.8	0.088
	Jul-98	ND	ND	ND	1.3	78	ND	6.9	3.9	0.420
VW-44-016	Feb-98	12	ND	ND	1.7	97	1.0	3.1	1.1	0.160
	Apr-98	7.2	ND	ND	ND	110	ND	ND	ND	0.200
	Jul-98	1.7	ND	ND	ND	64	0.98	5.0	3.1	0.160
VW-44-030	Feb-98	50	ND	ND	1.8	62	ND	ND	ND	0.580
	Apr-98	47	ND		ND	5.5	ND	1.6	2.1	0.800
	Jul-98	59	ND	ND	ND	ND	ND	3.0	ND	0.726
VW-45-012	Jul-98	55	11	0.26	ND	ND	9.9	7.2	6.0	21.300
VW-45-022	Feb-98	380	1,500	570	ND	ND	720	100	ND	11.000
	Apr-98	6,500	8,000	240	ND	ND	2,800	770	350	NR
	Jul-98	87	1.4	ND	ND	ND	9.9	0.72	ND	9.020
VW-45-030	Feb-98	17	ND	19	ND	ND	380	120	110	6.900
	Apr-98	ND	ND	ND	ND	ND	41	ND	ND	NR
	Jul-98	ND	ND	ND	ND	ND	4.7	ND	ND	2.780
VW-46-007	Jul-98	2.6	4.4	3.4	1.5	280	7.1	11	9.0	1.720
VW-46-015	Feb-98	ND	ND	15	200	130	ND	ND	ND	ND
	Apr-98	ND	ND	16	160	83	ND	ND	ND	ND
	Jul-98	ND	ND	16	160	68	ND	2.8	1.5	ND
VW-46-027	Feb-98	ND	ND	36	370	12	ND	ND	ND	ND
	Apr-98	ND	ND	28	230	7.0	ND	ND	ND	ND
	Jul-98	ND	ND	21	190	6.9	ND	2.6	1.4	ND

Table 5-1: Maximum Detected Concentrations of Selected Soil Gas Chemicals of Concern 1998 Sampling, WDI Vapor Monitoring Wells

Well / Probe Number		Vinyl Chloride	cis 1,2-DCE	TCE	PCE	1,1,1-TCA	Benzene	Toluene	m,p-Xylenes	Methane
	Boundary >>	12.5	930	.411	532	18,400	100	10,600	7,140	1.250
	Sample Date	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	%
VW-47-008	Apr-98	ND	ND	ND	1.0	1.1	ND	ND	ND	NR
	Jul-98	ND	ND	ND	1.4	ND	ND	4.2	2.2	< 0.001
VW-47-018	Feb-98	ND	ND	5.5	9.9	6.5	ND	2.5	1.6	0.068
	Apr-98	ND	ND	ND	5.7	ND	ND	ND	ND	0.290
	Jul-98	ND	ND	1.2	3.8	ND	1.2	3.1	1.9	0.500
VW-47-030	Feb-98	ND	ND	2.2	26	ND	ND	3.6	ND	0.210
	Apr-98	ND	ND	ND	6.5	ND	ND	ND	ND	0.160
	Jul-98	ND	ND	1.7	21	ND	ND	3.3	2.6	0.230
VW-48-008	Feb-98	520	ND	ND	ND	ND	2,200	ND	280	36.900
	Jul-98	750	100	ND	ND	ND	820	ND	ND	25.800
VW-48-017	Feb-98	ND	ND	ND	ND	ND	6,700	ND	6,400	53.900
	Apr-98	ND	ND	ND	ND	ND	5,800	ND	1,400	NR
	Jul-98	ND	ND	ND	ND	ND	4,200	ND	1,800	59.200
VW-48-035	Feb-98	ND	ND	ND	18	ND	12	9.4	32	3.700
	Apr-98	ND	ND	6.2	24	ND	13	ND	ND	NR
	Jul-98	ND	ND	ND	15	ND	ND	ND	ND	2.750
VW-49-010	Feb-98	ND	ND	3.8	55	1,300	ND	ND	ND	< 0.001
	Apr-98	ND	ND	4.9	50	410	ND	ND	ND	< 0.001
	Jul-98	ND	0.99	4.9	110	42	1.5	4.7	3.1	< 0.001
VW-49-018	Feb-98	ND	ND	16	730	570	ND	ND	ND	< 0.001
	Apr-98	ND	ND	5.7	360	6.5	ND	ND	ND	ND
	Jul-98	ND	ND	13	350	5.1	0.93	2.8	2.1	< 0.001
VW-49-030	Feb-98	ND	ND	17	900	3.2	ND	ND	ND	ND
	Apr-98	ND	ND	16	930	ND	ND	ND	ND	ND
	Jul-98	ND	ND	7.7	290	ND	ND	3.1	2.3	< 0.001
VW-50-008	Feb-98	ND	0.26	0.63	1.4	57	0.28	1.7	0.83	< 0.001
	Apr-98	ND	ND	ND	1.1	110	ND	ND	ND	< 0.001
VW-50-018	Feb-98	ND	ND	0.97	2.8	14	0.41	1.1	0.78	< 0.001
	Apr-98	ND	ND	ND	1.9	210	ND	ND	ND	< 0.001
VW-50-035	Feb-98	ND	6.5	4.0	2.8	6.6	ND	0.88	0.47	ND
	Apr-98	ND	1.4	2.9	2.8	13	ND	ND	ND	ND
VW-51-008	not sampled									
VW-51-018	Feb-98	ND	ND	ND	ND	230	14,000	ND	ND	46.000
	Apr-98	ND	ND	ND	ND	ND	1,200	ND	ND	NR
	Jul-98	ND	ND	ND	ND	ND	2,900	ND	410	24.100
VW-51-030	Feb-98	82	320	230	ND	160	320	ND	ND	7.700
	Apr-98	74	210	140	ND	ND	88	ND	ND	NR
	Jul-98	4.6	170	300	1,400	ND	28	1.9	1.9	< 0.001
VW-52-010	Jul-98	ND	ND	ND	2.8	ND	ND	5.3	ND	< 0.001
VW-52-019	Jul-98	ND	ND	ND	2.1	ND	ND	5.1	ND	ND
VW-52-030	Jul-98	ND	ND	3.5	89	0.49	ND	1.7	1.3	< 0.001
VW-53-010	Jul-98	14	88	34	ND	7.1	16	ND	ND	0.840
VW-53-020	Jul-98	21	160	1,000	34	ND	ND	ND	3.8	0.210
VW-53-030	Jul-98	7.0	82	790	33	ND	ND	ND	ND	< 0.001
VW-54-012	Jul-98	ND	ND	ND	ND	ND	2.6	7.6	ND	0.240
VW-54-020	Jul-98	2.7	7.3	4.9	0.81	ND	0.99	2.5	ND	0.240
VW-54-030	Jul-98	ND	7.2	3.8	0.49	ND	0.98	2.4	2.0	0.230

Table 5-1: Maximum Detected Concentrations of Selected Soil Gas Chemicals of Concern 1998 Sampling, WDI Vapor Monitoring Wells

Well / Probe Number		Vinyl Chloride	cis 1,2-DCE	TCE	PCE	1,1,1-TCA	Benzene	Toluene	m,p-Xylenes	Methane
	Boundary >>	12.5	930	411	532	18,400	100	10,600	7,140	1.250
	Sample Date	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	%
VW-55-010	not sampled									
VW-55-018	Jul-98	73	250	470	11	ND	20	ND	ND	3.000
VW-55-030	Jul-98	45	130	320	7.6	ND	7.0	ND	ND	1.800
VW-56-008	Jul-98	15	370	250	61	ND	27	ND	ND	0.002
VW-56-020	Jul-98	ND	46	600	48	ND	4.1	ND	ND	ND
VW-56-030	Jul-98	ND	7.7	720	47	ND	ND	ND	ND	ND
VW-57-007	Jul-98	ND	0.34	4.5	1.6	0.26	2.6	5.6	ND	0.024
VW-57-018	Jul-98	13	58	880	61	ND	ND	ND	ND	0.170
VW-57-026	Jul-98	ND	64	940	75	ND	ND	ND	ND	0.270
VW-58-008	Jul-98	ND	ND	3,900	58	79	39	ND	ND	ND
VW-58-019	Jul-98	ND	ND	3,500	110	ND	ND	ND	ND	ND
VW-58-029	Jul-98	ND	ND	3,100	110	ND	ND	ND	ND	ND
VW-59-008	Jul-98	ND	0.87	0.43	16	ND	4.3	2.5	ND	ND
VW-59-018	Jul-98	ND	ND	13	120	ND	ND	ND	ND	ND
VW-59-030	Jul-98	ND	ND	1.2	44	ND	ND	ND	ND	ND
VW-60-008	Jul-98	ND	ND	16	310	4.5		13	ND	ND
VW-60-019	Jul-98	ND	ND	4.2	36		0.48	14	ND	ND
VW-60-030	Jul-98	ND	ND	1.0	22	0.36	0.84	6.7	2.6	ND
VW-61-008	Jul-98	ND	ND	2.7	40	ND	2.1	3.3	ND	ND
VW-61-019	Jul-98	340	8.8	ND	ND	ND	8.7	ND	ND	0.390
VW-61-030	Jul-98	100	97	ND	ND	ND	ND	48	ND	0.130
VW-62-010	Jul-98	ND	ND	ND	ND	ND	ND	ND	ND	6.100
VW-62-018	Jul-98	1.4	0.48	0.6	0.23	ND	0.74	2.4	ND	2.500
VW-62-030	Jul-98	12	1.6	1.7	8.5	ND	0.82	2.9	3.1	3.100
VW-63-008	Jul-98	ND	ND	0.46	0.57	1.2	0.85	3.4	ND	ND
VW-63-019	Jul-98	ND	ND	7.5	120	ND	ND	ND	ND	ND
VW-63-030	Jul-98	ND	ND	14	200	ND	ND	ND	ND	ND
MP-01-005	Apr-98	ND	ND	ND	3.8	6.4	ND	ND	ND	NR
	Jul-98	ND	ND	ND	7.1	12	ND	2.0	1.1	< 0.001
MP-01-015	Apr-98	ND	ND	ND	ND	ND	120	ND	ND	NR
	Jul-98	ND	ND	ND	ND	ND	410	ND	ND	68.000
MP-02-005	Apr-98	ND	ND	4.2	130	ND	ND	ND	ND	NR
	Jul-98	ND	ND	4.7	150	ND	ND	1.3	0.84	< 0.001
MP-02-015	Feb-98	ND	ND	ND	ND	ND	64,000	ND	ND	76.000
	Apr-98	ND	ND	ND	ND	ND	60,000	1,600	5,200	NR
	Jul-98	ND	ND	ND	ND	ND	20,000	ND	ND	74.300

NOTES:
1. ppbv = parts per billion by volume
2. ND = not detected above laboratory reporting limit (see original data reports); NR = not reported
3. Table lists maximum detected concentrations of the selected indicator soil gas chemicals of concern from WDIG vapor well monitoring and USEPA sampling conducted Feb, Apr, and July 1998.
4. Interim Site (and building) Boundary Threshold Screening Levels for selected COCs from SGCP (CDM Federal, 1997)

Table 5-2: Vapor Well Locations Exceeding Soil Gas Threshold Levels
Waste Disposal,Inc. Site

		COCs Exceeding Threshold Screening Levels		
Well/Probe Identification	Location	February 1998 Sampling	April 1998 Sampling	July 1998 Sampling
SINGLE-SCREEN MONITORING WELLS				
VW-01-035	interior			
VW-02-035	interior	CH4		
VW-03-035	interior	CH4		
VW-04-023	interior	BZ, CH4	VC, BZ,	BZ, CH4
VW-05-029	interior			
VW-06-034	interior	VC, CH4		
VW-08-035	interior		VC	
VW-10-035	near building	VC	VC	VC
VW-11-035	near building	CH4	CH4	CH4
VW-12-034	interior			
VW-13-031	interior	VC, CH4	VC	VC
VW-14-035	interior	VC	VC, DCP	
VW-16-034	near building			
VW-17-035	near building			
VW-18-036	near building	BZ	BZ	BZ
VW-20-035	near building			
VW-21-036	near building	TCE		
VW-22-035	near building	TCE	TCE	TCE
VW-23-036	near building	TCE, VC	TCE, VC	TCE, VC
VW-24-035	interior			
VW-25-035	interior	BZ, CH4		
VW-26-035	interior		—	
MULTI-LEVEL MONITORING WELLS				
VW-27-009	interior	—		
VW-27-019	interior			—
VW-27-033	interior			—
VW-28-010	perimeter	—	—	
VW-28-025	perimeter	—	—	
VW-29-010	perimeter			
VW-29-023	perimeter			
VW-29-035	perimeter			
VW-30-007	perimeter		—	
VW-30-023	perimeter	CH4	—	
VW-30-035	perimeter	CH4	—	
VW 31-010	perimeter			
VW 31-030	perimeter			
VW-32-007	perimeter			
VW-32-018	perimeter			
VW-32-035	perimeter			
VW-33-010	perimeter			
VW-33-035	perimeter	TCE		
VW-34-010	perimeter			
VW-34-023	perimeter			
VW-34-040	perimeter			
VW-35-010	perimeter			
VW-35-038	perimeter	TCE	TCE	TCE

Table 5-2: Vapor Well Locations Exceeding Soil Gas Threshold Levels
Waste Disposal,Inc. Site

		COCs Exceeding Threshold Screening Levels		
Well/Probe Identification	Location	February 1998 Sampling	April 1998 Sampling	July 1998 Sampling
VW-36-010	perimeter			
VW-36-030	perimeter			
VW-37-010	perimeter			
VW-37-030	perimeter			
VW-38-010	perimeter			
VW-38-034	perimeter			
VW-39-007	perimeter	TCE		
VW-39-030	perimeter			
VW-40-010	perimeter		CH4	CH4
VW-40-025	perimeter			
VW-41-007	perimeter	---		
VW-41-020	perimeter	---		
VW-42-010	perimeter	---	---	
VW-42-030	perimeter	---	---	
VW-43-010	interior	---		
VW-43-019	interior	---	VC (CH4 not reported)	VC, CH4
VW-43-032	interior	---	VC (CH4 not reported)	VC, CH4
VW-44-007	interior			
VW-44-016	interior			
VW-44-030	interior	VC	VC	VC
VW-45-012	near building	---	---	VC, CH4
VW-45-021	near building	VC, DCE, TCE, BZ, CH4	VC, DCE, BZ,	VC, CH4
VW-45-030	near building	VC, BZ, CH4	(CH4 not reported)	CH4
VW-46-006	near building	---	---	CH4
VW-46-015	near building			
VW-46-027	near building			
VW-47-007	interior	---		
VW-47-018	interior			
VW-47-030	interior			
VW-48-008	interior	VC, BZ, CH4	---	VC, BZ, CH4
VW-48-017	interior	BZ, CH4	BZ, (CH4 not reported)	BZ, CH4
VW-48-035	interior	CH4	CH4 not reported	CH4
VW-49-010	interior			
VW-49-018	interior	PCE		
VW-49-030	interior	PCE	PCE	
VW-50-008	perimeter			---
VW-50-018	perimeter			---
VW-50-035	perimeter			---
VW-51-008	near building	---	---	---
VW-51-018	near building	BZ, CLFM, CH4	BZ (CH4 not reported)	BZ, CH4
VW-51-030	near building	VC, BZ, CH4	VC (CH4 not reported)	PCE
VW-52-010	interior	---	---	
VW-52-019	interior	---	---	DCP
VW-52-030	interior	---	---	
VW-53-010	near building	---	---	VC
VW-53-020	near building	---	---	VC, TCE
VW-53-030	near building	---	---	TCE

Table 5-2: Vapor Well Locations Exceeding Soil Gas Threshold Levels
Waste Disposal,Inc. Site

		COCs Exceeding Threshold Screening Levels		
Well/Probe Identification	Location	February 1998 Sampling	April 1998 Sampling	July 1998 Sampling
VW-54-012	near building	—	—	
VW-54-020	near building	—	—	
VW-54-030	near building	—	—	
VW-55-010	near building	—	—	—
VW-55-020	near building	—	—	VC, TCE, CH4
VW-55-030	near building	—	—	VC, CH4
VW-56-010	near building	—	—	VC
VW-56-020	near building	—	—	TCE
VW-56-030	near building	—	—	TCE
VW-57-010	near building	—	—	
VW-57-020	near building	—	—	VC. TCE
VW-57-030	near building	—	—	TCE
VW-58-008	near building	—	—	TCE
VW-58-019	near building	—	—	TCE
VW-58-030	near building	—	—	TCE
VW-59-008	near building	—	—	
VW-59-018	near building	—	—	
VW-59-030	near building	—	—	
VW-60-008	near building	—	—	
VW-60-019	near building	—	—	
VW-60-030	near building	—	—	
VW-61-008	near building	—	—	
VW-61-019	near building	—	—	VC, DCP
VW-61-030	near building	—	—	VC, DCP
VW-62-010	near building	—	—	CH4
VW-62-018	near building	—	—	CH4
VW-62-030	near building	—	—	CH4
VW-63-008	near building	—	—	
VW-63-018	near building	—	—	
VW-63-030	near building	—	—	
MP-01-005	near building	—		
MP-01-015	near building	—	CH4 not reported	CH4
MP-02-005	near building	—		
MP-02-015	near building	BZ, CH4	BZ (CH4 not reported)	BZ, CH4

Site/Building Boundary Interim Threshold Screening Levels (ITSL)

Methane (CH4)	12,500 ppmv	(1.25%)
Benzene (BZ)	100 ppbv	
Vinyl chloride (VC)	12.5 ppbv	
Trichloroethene (TCE)	411 ppbv	
Tetrachloroethene (PCE)	532 ppbv	
cis-1,2-Dichloroethene (DCE)	930 ppbv	
1,2-Dichloropropane (DCP)	93 ppbv	
Chloroform (CLFM)	170 ppbv	

(—) denotes monitoring well not sampled

Section 6.0

6.0 IN-BUSINESS AIR MONITORING EVALUATION

The USEPA and the WDIG have performed in-business air and ambient air background sampling during 1997-1998 at WDI to monitor and evaluate in-business air quality of the on-site businesses and buildings. As described in Section 3.2, in-business air sampling was initially conducted in all buildings at the site during the USEPA's 1997 subsurface gas investigation. Based on their location relative to buried waste and soil gas areas of concern, seven business located in seven separate on-site buildings have been selected for quarterly in-business air monitoring. Figure 6-1 shows the locations of the businesses and buildings which have been sampled during the 1998 in-business air monitoring program (TRC, 1999b). The following sections discuss the results of in-business air and ambient air background sampling with the specific objective of assessing the potential link between subsurface gas conditions and in-business air quality.

6.1 BACKGROUND AIR SAMPLING RESULTS

During each in-business air sampling event conducted by the USEPA or the WDIG, background samples were collected from a sampling location near the corner of Los Nietos Road and Greenleaf Avenue (Figure 6-1). The background sample results are used to identify the types and concentration of VOCs that are present in ambient air in the local area of the WDI site. This helps investigators recognize when VOC concentrations in the buildings are above normal levels for the Santa Fe Springs area.

Table 6-1 identifies the VOCs detected in the background air samples collected during the in-business air sampling. The results of ambient air samples collected by the California Air Resources Board (CARB) in Los Angeles in 1996 are also shown in Table 6-1. Except for the background sample collected in February 1998 by the WDIG (elevated BTEX concentrations reported), no background concentrations exceeded the WDI in-business air screening levels (Table 4-1) and most were below the maximum levels measured by the CARB in the Los Angeles area in 1996. The split background sample collected by the USEPA in February 1998 contained much lower concentrations than the WDIG sample. The cause for this discrepancy is not known. The results of other split soil gas samples collected during this sampling event were consistent with the WDIG results. For this reason, the WDIG background sample results for February 1998 are considered a sampling anomaly or outlier and are not used to evaluate the in-business air results.

6.2 OVERVIEW OF EVALUATION

The primary purpose of the WDI in-business air monitoring activities is to identify any potential air quality health concerns in any on-site businesses that may be due to subsurface soil gas migration into the buildings. For this evaluation, the following decision criteria were used to assess possible soil gas migration and to identify potential health concerns with in-business air quality:

- Is the compound detected in in-business air samples?
- Is the compound also detected in subsurface soil gas near the building?
- Does the maximum in-business air concentration exceed ambient air background levels?
- Does the maximum in-business air concentration exceed the 1997 interim threshold screening levels or the more current 1998 USEPA ambient air PRGs?

A compound detected in soil gas was not considered a likely source of in-business air contamination if only trace concentrations were detected in soil gas near the building (i.e., less than 1 ppbv). Soil gas was also not considered a likely source of in-business air contamination if the in-business concentration was much greater than the soil gas concentration. This is because in-business air concentrations resulting from the migration and infiltration of soil gas into buildings would be measurably reduced when diluted with ambient air. For this reason, the ratio of the maximum in-business air to soil gas concentration was considered in the evaluation of the buildings.

Using the criteria described above, Table 6-2 identifies compounds that are potential health concerns in the buildings. This evaluation used the in-business air data collected by the USEPA in 1997 and the maximum soil gas concentrations detected in the vapor monitoring well network in 1997-1998. The VOCs that may be of concern are highlighted in bold and include the following: 1,1-DCE; 1,2,4-trimethylbenzene; 1,3,5-trimethylbenzene; benzene; chloromethane; m-&p-xylene; methylene chloride; PCE; toluene; TCE; and vinyl chloride. However, the presence of many of these VOCs appears to be due to business operations occurring within the buildings (see the SGCP Report, CDM Federal, 1999a).

6.3 EVALUATION OF SAMPLING RESULTS

In addition to the site-wide in-business air sampling conducted in 1997, seven on-site businesses/buildings were specifically selected for frequent in-business air monitoring because of their proximity to soil gas areas of concern and buried wastes. This evaluation focused on the seven businesses which have been sampled monthly and/or quarterly during the WDIG's 1998 in-business air monitoring program. The locations and addresses of the selected businesses/buildings reviewed for this evaluation are shown on Figure 6-1.

For each of the seven sampling locations evaluated, all compounds detected in in-business air samples during the August 1997 through November 1998 monitoring events were compared to ambient air background concentrations and the interim threshold screening levels. Additionally, the soil gas data for the vapor monitoring wells located within 50 feet of the building locations were reviewed to assess the potential for soil gas migration into the buildings. The following sections summarize the results of this evaluation.

6.3.1 9843 Greenleaf Avenue

Table 6-3 provides an evaluation of the compounds detected in in-business air at 9843 Greenleaf Avenue. The in-business air and soil gas data collected to date do not provide evidence that soil gas migration has resulted in any health concerns at 9843 Greenleaf Avenue. Two of the most notable compounds detected in soil gas near 9843 Greenleaf Avenue are benzene and methane. A benzene concentration of 64,000 ppbv and a methane concentration of 743,000 ppmv (74%) was detected at MP-02. Vapor wells MP-01 and VW-51 also contain elevated levels of benzene and methane. However, the in-business air concentrations of these two compounds inside 9843 Greenleaf Avenue are below WDI screening levels. Benzene in in-business air is less than background concentrations and methane has only been above 3 ppmv in August 1997. In August 1997, 39 ppmv of methane was detected in in-business air. This is the highest methane concentration detected in any of the buildings and is ten times greater than the background concentration. However, 39 ppmv (equivalent to 0.0039%) of methane does not represent a health concern or an explosive hazard and similar levels have not been observed in the five subsequent sampling episodes conducted at 9843 Greenleaf Avenue in 1998.

Another consideration at 9843 Greenleaf Avenue is the size of the building and the chemicals used within the building. The most likely source of benzene or other fuel-related compounds detected in in-business air would be the petroleum products and hydraulic oils used in the building rather than the migration of soil gas. In addition, except for a few small offices in the front of the building closest to Greenleaf Avenue, most of the building at 9843 Greenleaf Avenue consists of one very large warehouse containing its machines. This building would require a large volume of soil gas emissions before measurable concentrations of VOCs built up in in-business air.

6.3.2 12811E Los Nietos Road

Table 6-4 identifies benzene and 1,2,4-trimethylbenzene as the only compounds that have been detected above screening levels and are potentially related to soil gas near 12811E Los Nietos Road. However, no definitive link between soil gas and in-business air can be made because these compounds are constituents of petroleum products commonly used at the businesses located adjacent to 12811E Los Nietos Road. Because these compounds are present at relatively low concentrations in soil gas, soil gas migration is not a likely cause of the benzene and 1,2,4-trimethylbenzene detected in in-business air. The maximum 1,2,4-trimethylbenzene concentration in soil gas near 12811E Los Nietos Road is 44 ppbv, which is less than the provisional soil gas performance standard (100 ppbv). The maximum benzene concentration in soil gas is 20 ppbv, which is slightly greater than the provisional soil gas standard of 10 ppbv. One of the most notable compounds detected in soil gas near 12811F Los Nietos Road is methane (30,000 ppmv in VW-55). The maximum concentration of methane detected in in-business air samples at 12811E Los Nietos Road is only 3.5 ppmv.

6.3.3 12635 Los Nietos Road

Table 6-5 identifies three VOCs (1,2,4-trimethylbenzene, benzene, and vinyl chloride) that were detected above screening levels in air and could be related to soil gas migration at 12635 Los Nietos Road. However, the presence of benzene and 1,2,4-trimethylbenzene may be due to the business operations conducted at 12635 Los Nietos Road. Benzene and 1,2,4-trimethylbenzene are constituents of petroleum products and the business at 12635 Los Nietos Road uses over five different types of petroleum-based cleaning solvents and lubricating oils for industrial operations (CDM Federal, 1999a).

Vinyl chloride is not a known constituent of chemicals used at 12635 Los Nietos Road. However, it should be noted that vinyl chloride was detected only once in five sampling events at 12635 Los Nietos Road at a concentration (0.5 ppbv) which is near the analytical detection limit. Therefore, there is some uncertainty associated with validity of the vinyl chloride result for this sampling location.

6.3.4 12637A Los Nietos Road

In-business air and soil gas data collected to date does not show evidence that soil gas has impacted in-business air quality at 12637A Los Nietos Road. Table 6-6 provides an evaluation of the compounds detected in in-business air at 12637A Los Nietos Road. Benzene is the only compound detected above screening levels that may be associated with soil gas. However, the maximum benzene concentration detected in in-business air (2.7 ppbv) is only slightly above the screening level (2.0 ppbv) and the maximum soil gas concentration near 12637A Los Nietos Road is 8.7 ppbv, which is less than the provisional soil gas performance standard (10 ppbv). Given the building's location, the benzene detected in in-business air may be due to vehicle exhaust or to petroleum products used by the business located adjacent to 12637A Los Nietos Road. An additional potential source of the benzene in in-business air, at such a low concentration, may be tobacco smoke.

6.3.5 12637B Los Nietos Road

In-business air and soil gas data collected to date does not show evidence that soil gas has impacted in-business air quality at 12637B Los Nietos Road. Table 6-7 provides an evaluation of the compounds detected in in-business air at 12637B Los Nietos Road. None of the in-business air contaminants detected above screening levels were detected in the soil gas near 12637B Los Nietos Road. While the soil gas methane levels near 12637B Los Nietos Road are greater than 20% in some locations, the maximum methane concentration detected in in-business air is 3.3 ppmv, which is close to the background concentration (2.5 ppmv). It should be noted that any contaminants detected in the in-business air at 12637B Los Nietos Road may be due to the solvents and machine oils that are used at this building (CDM Federal, 1999a).

6.3.6 9632 Santa Fe Springs Road

Table 6-8 identifies TCE as the only compound that has been detected above screening levels and is potentially related to soil gas near 9632 Santa Fe Springs Road. However, no definitive link between soil gas and in-business air can be made because this compound is a constituent of the Safety-Kleen Recycled 105 Solvent-California used at 9632 Santa Fe Springs Road. Since TCE is present at relatively low concentrations in soil gas, soil gas migration is not a likely cause of the TCE in in-business air. The maximum TCE concentration detected in soil gas near 9632 Santa Fe Springs Road is 37 ppbv, which is less than the provisional soil gas performance standard (200 ppbv). In March 1998, a new business began operating at 9632 Santa Fe Springs Road. This business does not use the Safety Kleen solvent and TCE has not been detected above screening levels in in-business air since this new business began operating at 9632 Santa Fe Springs Road.

6.3.7 12633 Los Nietos Road

Table 6-9 identifies benzene as the only compound that has been detected above interim threshold screening levels during in-business sampling at 12633 Los Nietos Road. The benzene screening level of 2.0 ppbv was exceeded once (9.4 ppbv, May 1998) out of the four sampling events conducted at this building. As listed in Table 6-9, benzene has been detected in soil gas samples in a nearby vapor monitoring well at a maximum concentration of 1,600 ppbv (VW-18, February 1998). However, no definitive link between soil gas and in-business air can be made because other potential sources of benzene can not be ruled out. Given that the business at 12633 Los Nietos Road is located in close proximity to machine shops, industrial businesses, and city streets with high vehicle traffic, the benzene detected in the in-business air samples may be related to vehicle exhaust or petroleum products used in adjacent buildings. An additional potential source of the benzene detected in the in-business air sample may be tobacco smoke.

6.4 CONCLUSIONS

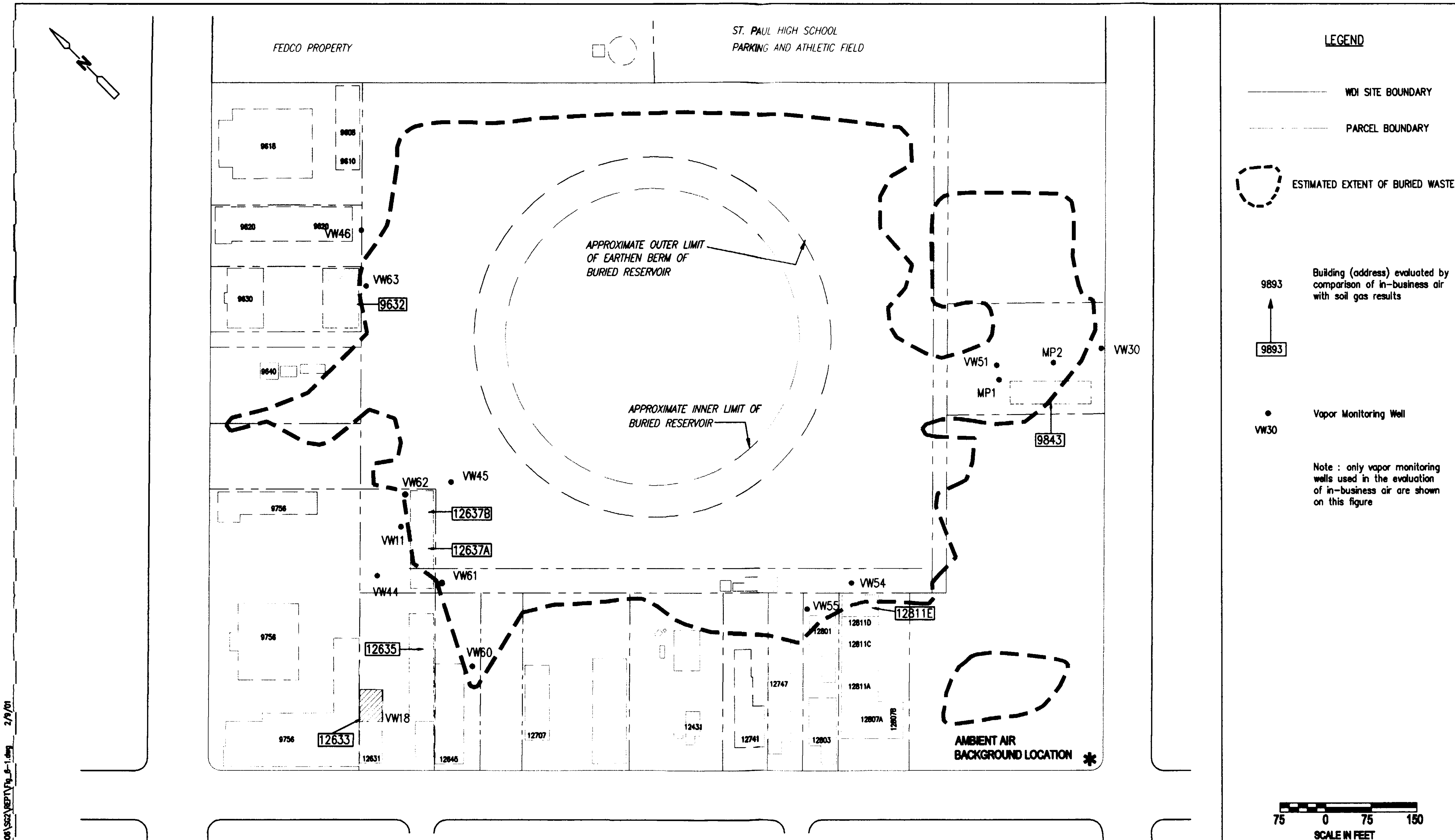
Based on the results of the in-business air data collected in 1997 and 1998, no potential health concerns due to subsurface soil gas migration were identified at 9843 Greenleaf Avenue, 12637B Los Nietos Road, or 12637A Los Nietos Road. Several VOCs were identified above the interim threshold screening levels in in-business air sample results that could be related to subsurface gas migration at 12811E Los Nietos Road, 12633 Los Nietos Road, 12635 Los Nietos Road, and 9632 Santa Fe Springs Road. However, the more likely sources of these VOCs are the industrial products/chemicals used by the businesses at these locations. The in-business air sampling data collected to date do not provide definitive or conclusive evidence of subsurface gas migration into the buildings because of several site-specific factors of uncertainty as described below.

The primary source of uncertainty preventing a definitive conclusion regarding subsurface gas migration into the buildings is the use of chemicals by some of the businesses within the buildings. Many of the chemicals detected in in-business air samples are also constituents of the industrial products and chemicals used within the buildings. A business that operated at 9632 Santa Fe Springs Road in 1998, for example, used the Safety- Kleen Recycled 105 Solvent-California which contains petroleum distillates, PCE (0-0.5%), 1,1,1-TCA (0-0.5%) and detectable amounts of benzene, carbon tetrachloride, 1,4-dichlorobenzene, DCA, toluene, and TCE. The business at 12635 Los Nietos Road currently uses several types of cleaning solvents and lubricating oils for its machines. Other potential sources of VOCs used within the buildings include gasoline, hydraulic oils, and the use of personal vehicles and other machinery (i.e., forklifts). Many of the individuals inside the buildings also smoke, which is another potential source of benzene in in-business air.

An indication that compounds detected in the buildings may be due to the business operations occurring within the buildings is that in-business air concentrations are sometimes greater than soil gas concentrations, and thus are not at likely to be present as a result of migration. Benzene and 1,1,1- TCA are two examples of chemicals that are commonly present at higher concentrations in in-business air than in soil gas. Benzene constitutes 1- 2% of most blends of gasoline and 1,1,1-TCA constitutes up to 0.5% of the recycled Safety-Kleen solvent. Another consideration is that many businesses are located in close proximity to each other, so it is feasible for the operations occurring in one building to affect the air quality in the other.

A second source of uncertainty preventing any definitive conclusions regarding subsurface gas migration into the buildings is the soil gas chemistry directly beneath the buildings. To avoid disrupting business operations within the buildings, subsurface gas sampling is conducted in monitoring wells near but not directly adjacent to the buildings. Because many of the vapor wells are purposely installed in soil gas areas of concern, the concentrations in soil gas constituents directly beneath the buildings may be much less than the concentrations measured in the vapor monitoring wells. During the USEPA's SGCP investigation, field screening was conducted with representatives from the Los Angeles County Department of Health Services, in which portable air monitoring instruments were used to field survey the floors of the on-site businesses and other entry points for evidence of VOCs and methane. No indications or evidence of VOCs or methane were identified during the in-business field surveys conducted in July and August 1997.

A third source of uncertainty is the potential for infiltration of outside air which could bias or affect the in-business air sampling results. Even though the in-business air samples were collected over the weekend when the businesses are more likely to be closed, there is no guarantee that the building remained closed and that in-business air was not ventilated with outside air. In addition, many of the buildings consist of very large warehouses or machine shops. These buildings would require a large volume of soil gas infiltration into the building before measurable concentrations of VOCs built up in in-business air. For this reason, during both the USEPA's and WDIG's in-business air monitoring, an effort was made to place the sampling canisters in small rooms such as offices or bathrooms.



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SAMPLING LOCATIONS REVIEWED FOR IN-BUSINESS AIR MONITORING EVALUATION
WASTE DISPOSAL INC.
SANTA FE SPRINGS, CALIFORNIA

Figure 6-1

Table 6-1
SUMMARY OF BACKGROUND AMBIENT AIR SAMPLING RESULTS
SAMPLES COLLECTED AT THE CORNER OF LOS NIETOS AND GREENLEAF

Sample Location	Background	Background	Background	Background	Background	Background	Background	Background	Background
Sample Date	8/4/97	8/10/97	8/18/97	8/25/97	9/22/97	2/9/98	2/9/98	3/9/98	4/6/98
Laboratory	EPA Reg. 9	EPA Reg. 9	Quanterra	Quanterra	Quanterra	TRC (1)	Quanterra	TRC	TRC
Laboratory Parameter	Result (ppbv)	Result (ppbv)	Result (ppbv)	Result (ppbv)	Result (ppbv)	Result (ppbv)	Result (ppbv)	Result (ppbv)	Result (ppbv)
1,1,1-Trichloroethane	0.9	ND	ND	0.24	0.44	ND	ND	ND	ND
1,2,4-Trimethylbenzene	**0.5**	**0.3**	**2.3**	**ND**	**1.10**	**NR**	**ND**	**NR**	**NR**
1,2-Dichlorobenzene	ND	ND	ND	ND	1.10	ND	ND	ND	ND
1,3-Dichlorobenzene	**ND**	**ND**	**ND**	**1.2**	**ND**	**ND**	**ND**	**ND**	**ND**
1,4-Dichlorobenzene	ND	ND	ND	ND	0.36	ND	ND	ND	ND
2-Butanone	**NR**	**NR**	**NR**	**NR**	**NR**	**13**	**NR**	**1.7**	**3.1**
Acetone	NR	NR	NR	NR	NR	21	NR	4.6	5.3
Benzene	**2**	**0.5**	**1.2**	**1.0**	**1.40**	**390**	**0.83**	**1.5**	**ND**
Chloromethane	0.5	0.5	ND	2.70	0.54	ND	ND	ND	ND
Dichlorodifluoromethane	**0.7**	**0.5**	**ND**	**ND**	**ND**	**NR**	**ND**	**NR**	**NR**
Ethylbenzene	0.5	ND	ND	ND	ND	1,000	ND	ND	ND
m- & p-Xylene(s)	**2**	**0.4**	**3.7**	**ND**	**2.20**	**2,900**	**ND**	**1.9**	**1.3**
Methyl tert-Butyl Ether	NR	NR	NR	NR	NR	5.2	NR	5.7	2.5
Methylene chloride	**ND**	**ND**	**ND**	**0.77**	**0.87**	**ND**	**0.63**	**ND**	**ND**
o-Xylene	0.6	0.3	1.5	ND	ND	1200	ND	ND	ND
Styrene	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**
Tetrachloroethene	0.4	ND	ND	ND	0.24	ND	0.26	ND	1.10
Toluene	**4**	**1**	**5.2**	**2.1**	**4.30**	**6700**	**2.9**	**4.9**	**2.9**
Trichloroethene	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichlorofluoromethane	**0.3**	**0.3**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**
Methane (ppm)	NR	NR	NR	ND	ND	2.6	ND	2.20	2.4
Total non-methane hydrocarbons	NR	NR	NR	ND	ND	440	ND	4.60	ND

Sample Location	Background	Background
Sample Date	5/3/98	Jul-98
Laboratory	Quanterra	TRC
Laboratory Parameter	Result (ppbv)	Result (ppbv)
1,1,1-Trichloroethane	ND	ND
1,2,4-Trimethylbenzene	**ND**	**NR**
1,2-Dichlorobenzene	ND	ND
1,3-Dichlorobenzene	**ND**	**ND**
1,4-Dichlorobenzene	ND	ND
2-Butanone (methyl ethyl ketone)	**NR**	**1.4**
Acetone	NR	5.6
Benzene	**0.33**	**1.4**
Chloromethane	ND	ND
Dichlorodifluoromethane	**ND**	**NR**
Ethylbenzene	ND	ND
m- & p-Xylene(s)	**ND**	**3.0**
Methyl tert-Butyl Ether	NR	3.2
Methylene chloride	**ND**	**ND**
o-Xylene	ND	1.4
Styrene	**ND**	**ND**
Tetrachloroethene	ND	ND
Toluene	**0.98**	**3.7**
Trichloroethene	ND	ND
Trichlorofluoromethane	**ND**	**ND**
Methane (ppm)	ND	2.5
Total non-methane hydrocarbons	ND	10

Maximum (1) Background at WDI	1996 Mean Concentration in L.A. (2)	Maximum Concentration in L.A. (2)	WDI Indoor Air Screening Level
Result (ppbv)	Result (ppbv)	Result (ppbv)	Result (ppbv)
0.90	NA	NA	368
2.30	**NA**	**NA**	**NA**
1.10	0.10	0.50	NA
1.20	**NA**	**NA**	**NA**
0.36	0.12	0.50	NA
1.40	**0.16**	**0.90**	**NA**
5.60	NA	NA	312
2.00	**1.48**	**7.3**	**2.0**
2.70	NA	NA	NA
0.70	**NA**	**NA**	**NA**
0.50	0.54	2.6	490
3.70	**2.14**	**9.7**	**142.8**
3.20	NA	NA	NA
0.87	**1.10**	**3.3**	**NA**
1.50	NA	NA	142.8
0.00	**0.09**	**0.4**	**NA**
1.10	0.502	1.5	10.6
5.20	**4.44**	**18**	**212**
0.00	0.173	0.62	8.2
0.30	**NA**	**NA**	**NA**
2.50	NA	NA	12,500
10	NA	NA	NA

(1) The February sampling event conducted by the WDIG is not included in the estimate of the maximum background concentration at WDI.

(2) Source = California EPA Air Resources Board. Data collected from 1630 North Main Street in Los Angeles in 1996. Number of observations = 28.

ND = compound analyzed for, but not detected

NR = no analysis for this compound

ppbv = parts per billion by volume

ppmv = parts per million by volume

Table 6-2
1997 IN-BUSINESS AIR SAMPLING RESULTS
VOC concentrations in parts per billion (ppbv)

Sample Location	Brothers Machine Shop	Metro Diesel	R&R Sprouts	Buffalo Bullet	C&E Die Fab	Bell Auto Body	D&H Laminating	Dan Ray	California Reamer	Durango Plastics	Vacant	Four C's Transmission	Bert's Auto	Leo's Lawnmower
Sample Address	9843 Greenleaf Ave.	12631 Los Nietos Rd.	12633 Los Nietos Rd.	12637A Los Nietos Rd.	12637B Los Nietos Rd.	12645 Los Nietos Rd.	12707 Los Nietos Rd.	12741A Los Nietos Rd.	12747 Los Nietos Rd.	12803A Los Nietos Rd.	12801B Los Nietos Rd.	12807A Los Nietos Rd.	12809B Los Nietos Rd.	12811C Los Nietos Rd.
Sample Date	Maximum	8/11/97	8/25/97	8/11/97	Maximum	8/25/97	8/18/97	8/18/97	8/4/97	8/25/97	8/25/97	8/18/97	8/18/97	8/18/97
1,1,1-Trichloroethane	0.32	0.6	ND	3.0	3.0	0.7	0.2	30.0	0.3	0.3	0.8	0.27	ND	ND
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2-Trichlorotrifluoroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4-Trimethylbenzene	0.6	3.0	1.0	0.4	0.5	2.0	1.1	**7.7**	1.0	2.0	**11**	**12**	**22**	**100**
1,2-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.36	ND	ND
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloropropane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3,5-Trimethylbenzene	0.2	0.9	0.3	ND	ND	0.2	ND	**2.5**	0.3	0.4	**3.0**	**4.2**	**6.6**	**38.0**
1,4-Dichlorobenzene	0.63	ND	ND	ND	ND	ND	ND	ND	ND	4.0	ND	ND	0.99	ND
Benzene	1.9	0.8	0.6	0.4	0.73	**3.0**	1.4	1.9	1.0	0.7	1.0	**2.7**	**17**	**61**
Bromomethane	ND	ND	ND	ND	ND	ND	ND	1.0	ND	ND	ND	ND	ND	ND
Carbon tetrachloride	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chlorobenzene	ND	ND	ND	0.6	ND	ND	ND	ND	ND	ND	2.0	ND	ND	ND
Chloroform	ND	0.6	ND	ND	ND	ND	ND	ND	ND	0.3	ND	ND	ND	ND
Chloromethane	2.0	0.5	0.6	0.5	1.6	2.0	0.63	0.61	2.0	0.8	0.6	0.61	ND	ND
Dichlorodifluoromethane	0.6	0.8	1.0	0.6	0.5	0.9	ND	ND	0.8	0.7	2.0	3.4	ND	ND
Ethylbenzene	1.1	1.0	0.3	0.5	0.5	7.0	ND	2.4	0.8	0.5	2.0	5.1	19	91
m- & p- Xylene(s)	4.4	4.0	1.0	1.0	3.3	23	ND	9.7	2.0	2.0	6.0	21	75	**330**
Methylene chloride	0.8	**370**	**7.0**	**4.0**	**5.0**	1.0	ND	ND	ND	**42**	**2.0**	**3.6**	ND	**8.0**
o-Xylene	1.3	2	0.4	0.4	1.0	7.0	ND	3.8	1.0	0.8	2.0	8.5	26.0	120.0
Styrene	0.5	ND	0.3	2.0	ND	1.0	1.2	1.5	0.4	0.5	1	1.4	4.9	ND
Tetrachloroethene	1.5	0.8	ND	ND	ND	ND	ND	0.22	0.4	ND	0.2	ND	1.8	ND
Toluene	8.6	13	2.0	1.0	6.9	81	3.0	15.0	5.0	41	7.0	21.0	120.0	**380.0**
Trichloroethene	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.0	ND	ND	ND	ND
Trichlorofluoromethane	0.4	0.3	0.7	0.3	0.3	0.3	ND	ND	1.0	0.4	0.4	ND	ND	ND
Vinyl Chloride	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Table 6-2
1997 IN-BUSINESS AIR SAMPLING RESULTS
VOC concentrations in parts per billion (ppbv)

Sample Location	Hernandez Auto	Rolland's Welding	Lift Truck Converter	Lovell Cabinets	Action Maintenance	Dry Print	E&L Electric	Mersits Equipment	Air Liquide Bldg #1	Air Liquide Bldg. #2	Air Liquide Bldg. #3	Stansell Brothers	Timmons Wood Products	Peoples
Sample Address	12811D Los Nietos Rd.	9608 Santa Fe Spgs. Rd.	9610 Santa Fe Spgs. Rd.	9618 Santa Fe Spgs Rd. #15	9620A Santa Fe Spgs Rd.	9620B Santa Fe Spgs Rd.	9632 Santa Fe Spgs Rd.	9640 Santa Fe Spgs Rd.	9756 Santa Fe Spgs Rd.	9756 Santa Fe Spgs Rd.	9756 Santa Fe Spgs Rd.	12635 Los Nietos Rd.	12731 Los Nietos Rd.	12741B Los Nietos Rd.
Sample Date	8/18/97	8/25/97	8/25/97	8/11/97	8/4/97	8/4/97	Maximum	8/4/97	8/18/97	8/18/97	8/18/97	Maximum	9/15/97	9/22/97
1,1,1-Trichloroethane	ND	0.6	0.5	28	2.0	2.0	0.6	2.0	1.9	1.2	0.6	3.0	0.8	45
1,1,2,2-Tetrachloroethane	**1.4**	**10**	**2**	ND	**0.3**	ND	ND	ND	ND	ND	ND	1.0	ND	ND
1,1,2-Trichlorotrifluoroethane	ND	ND	0.3	ND	ND	0.3	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.3	ND
1,1-Dichloroethene	ND	ND	ND	ND	ND	ND	**0.3**	ND	ND	ND	ND	ND	ND	ND
1,2,4-Trimethylbenzene	**29**	**73**	**15**	0.7	0.6	0.6	2.0	0.7	**3.0**	ND	ND	**12**	1.0	2.2
1,2-Dichlorobenzene	ND	0.5	1.0	ND	0.5	ND	1.2	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethane	ND	0.6	1.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.0	ND
1,2-Dichloropropane	1.2	0.4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3,5-Trimethylbenzene	**10**	**18**	**5.0**	0.4	ND	0.3	0.5	0.3	ND	ND	ND	**4.0**	0.4	ND
1,4-Dichlorobenzene	33	0.2	3.4	ND	0.5	ND	0.51	ND	0.35	0.66	ND	ND	ND	ND
Benzene	**17**	**32**	9.0	0.8	0.4	1.0	2.0	0.9	0.96	0.50	0.43	**6.0**	1.0	**2.6**
Bromomethane	ND	ND	ND	ND	ND	DN	ND	ND	ND	ND	ND	ND	0.2	ND
Carbon tetrachloride	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.5	ND	ND
Chlorobenzene	1.2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.68
Chloroform	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2	ND	0.62
Chloromethane	ND	0.6	0.5	1.0	0.6	0.6	0.6	1.0	0.46	0.41	0.46	0.90	0.8	ND
Dichlorodifluoromethane	ND	1.0	1.0	0.9	1.0	0.6	0.7	1.0	ND	ND	ND	8.0	1	3.5
Ethylbenzene	27	39	11	1	0.3	0.8	13	2.0	1.0	ND	ND	9.0	8	2
m- & p- Xylene(s)	99	**150**	45	4.0	0.4	3.0	45	6.0	4.8	ND	ND	35	25	7.7
Methylene chloride	**38**	**63**	**19**	**3.0**	**4.0**	**47**	ND	**5.0**	ND	ND	ND	**2.0**	**2.0**	**8.3**
o-Xylene	37	58	16	0.6	0.3	1.0	21	2.0	1.8	ND	ND	13.0	5	2.4
Styrene	7.6	2.0	0.6	ND	0.3	0.4	ND	ND	ND	ND	ND	1.0	ND	ND
Tetrachloroethene	**61**	3.0	3.0	ND	**12.0**	0.2	1.0	ND	0.57	ND	ND	0.80	0.3	0.84
Toluene	150	**240**	75	15	9.0	12	15	8.0	5.7	2.4	1.3	66.0	140	25
Trichloroethene	ND	0.3	0.5	ND	0.7	ND	**14**	ND	ND	ND	ND	0.8	0.3	0.53
Trichlorofluoromethane	ND	0.3	0.3	0.3	0.3	0.3	0.4	0.4	ND	ND	ND	1.0	0.6	12
Vinyl Chloride	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**0.5**	ND	ND

Table 6-2
1997 IN-BUSINESS AIR SAMPLING RESULTS
VOC concentrations in parts per billion (ppbv)

Sample Location	Vacant	Vacant	Vacant	Maximum Indoor Air Conc (ppbv)	Maximum Background Concentration (ppbv)	WDI Indoor Air Screening Level (ppbv)	USEPA Region 9 Residential PRG (ppbv)	Does maximum indoor air conc exceed WDI screening level?	Does maximum indoor air conc exceed USEPA PRG?	Maximum Soil Gas Concentration Detected in Vapor Wells (ppbv)	Comment
Sample Address	9618 Santa Fe Spgs Rd. #8	9618 Santa Fe Spgs Rd. #10	9618 Santa Fe Spgs Rd. #12								
Sample Date	9/15/97	9/15/97	9/15/97								
1,1,1-Trichloroethane	0.3	0.4	0.6	45	0.90	368	184	NO	NO	1400	Below screening levels
1,1,2,2-Tetrachloroethane	ND	ND	ND	10	ND	NA	0.0048		YES	0.77	Max soil gas conc = 0.77
1,1,2-Trichlorotrifluoroethane	ND	ND	ND	0.3	ND	NA	4061		NO	14	Below screening levels
1,1,2-Trichloroethane	ND	ND	ND	0.3	ND	4.4	0.022	NO	YES	12	Below WDI screening level
1,1-Dichloroethene	ND	ND	ND	0.3	ND	NA	0.01		YES	290	**Potential COC**
1,2,4-Trimethylbenzene	0.5	0.8	0.9	100	2.3	NA	1.3		YES	140	**Potential COC**
1,2-Dichlorobenzene	ND	ND	ND	1.2	1.1	NA	35		NO	57	Below screening levels
1,2-Dichloroethane	ND	ND	ND	1.0	ND	3.6	0.018	NO	YES	293	Below WDI screening level
1,2-Dichloropropane	ND	ND	ND	1.2	ND	1.86	0.021	NO	YES	250	Below WDI screening level
1,3,5-Trimethylbenzene	ND	0.3	0.3	38	ND	NA	1.3		YES	670	**Potential COC**
1,4-Dichlorobenzene	ND	ND	ND	33	0.36	NA	0.047		YES	5.6	Max soil gas conc = 5.6
Benzene	1.0	1.0	2.0	61	2.0	2.0	0.072	YES	YES	13000	**Potential COC**
Bromomethane	ND	ND	0.2	1.0	ND	NA	1.3		NO	ND	Not detected in soil gas
Carbon tetrachloride	ND	ND	ND	0.5	ND	0.68	0.021	NO	YES	78	Below WDI screening level
Chlorobenzene	ND	ND	ND	2.0	ND	NA	4.6		NO	300	Below screening levels
Chloroform	ND	ND	ND	0.62	ND	3.4	0.017	NO	YES	820	Below WDI screening level
Chloromethane	0.5	0.6	**6.0**	6.0	2.7	NA	0.53		YES	6200	**Potential COC**
Dichlorodifluoromethane	0.7	0.8	0.9	8.0	ND	NA	43		NO	6.3	Below screening levels
Ethylbenzene	0.4	0.5	0.7	91	0.5	490	254	NO	NO	3100	Below screening levels
m- & p- Xylene(s)	2.0	2.0	3.0	330	3.7	142.8	169	YES	YES	5600	**Potential COC**
Methylene chloride	ND	1.0	1.0	370	0.87	NA	1.2		YES	580	**Potential COC**
o-Xylene	0.5	0.7	0.9	120	1.5	142.8	169	NO	NO	1600	Below screening levels
Styrene	ND	ND	0.4	7.6	ND	NA	259		NO	201	Below screening levels
Tetrachloroethene	0.6	0.4	0.7	61	1.1	10.6	0.49	YES	YES	1088	**Potential COC**
Toluene	6.0	7.0	**440**	440	5.2	212	107	YES	YES	4700	**Potential COC**
Trichloroethene	ND	ND	ND	14	ND	8.2	0.21	YES	YES	3900	**Potential COC**
Trichlorofluoromethane	0.3	0.4	0.4	12	0.3	NA	131		NO	60	Below screening levels
Vinyl Chloride	ND	ND	ND	0.5	ND	0.25	0.0086	YES	YES	6500	**Potential COC**

Table 6-3
EVALUATION OF IN-BUSINESS AIR SAMPLING CONDUCTED AT 9843 GREENLEAF AVENUE
AUG 1997 THROUGH JULY 1998 SAMPLING

9843 Greenleaf Ave.	Maximum Indoor Air Conc (ppbv)	Maximum Soil Gas Conc Near Buildng (1)		Maximum Background Conc (ppbv)	WDI Indoor Air Screening Level (ppbv)	USEPA Residential Ambient Air PRG (ppbv)	Ratio of Air/Gas Concentration (%)	Is indoor air contaminant related to soil gas?	Is indoor air greater than background concentration?	Is indoor air greater than WDI screening level?	Is indoor air greater than residential PRG?	Comment regarding indoor air contaminant
		Max Conc (ppbv)	Vapor Well Probe									
1,1,1-Trichloroethane	0.32	1000	VW30-007	0.90	368	184	0.03%	potentially	NO	NO	NO	Less than background
1,2,4-Trimethylbenzene	0.60	180	VW51-030	2.3	NA	1.3	0.33%	potentially	NO		NO	Less than background
1,2-Dichlorotetrafluoroethane	1.0	ND		ND	NA	NA		not in gas			NO	Not detected in soil gas near building
1,3,5-Trimethylbenzene	0.20	130	VW51-030	ND	NA	1.3	0.15%	potentially			NO	Less than screening level
1,4-Dichlorobenzene	0.70	ND		0.36	NA	0.047		not in gas	YES		YES	Not detected in soil gas near building
2-Butanone	2.0	0.89	VW30-023	1.4	NA	340	225%	unlikely	YES		NO	Less than screening level
Acetone	15	2247.0	MP1-015	5.6	312	156	1%	unlikely	YES	NO	NO	Less than screening level
Benzene	1.9	64,000	MP2-015	2.0	2.0	0.072	0.003%	potentially	NO	NO	YES	Less than background
Chloromethane	2.0	ND		2.7	NA	0.53		not in gas	NO		YES	Not detected in soil gas near building
Dichlorodifluoromethane	0.60	ND		0.70	NA			not in gas	NO		YES	Not detected in soil gas near building
Ethylbenzene	1.1	810	VW51-018	0.50	490	254	0.14%	potentially	YES	NO	NO	Less than screening level
m- & p- Xylene(s)	4.4	5600	MP2-015	3.7	142.8	169	0.08%	potentially	YES	NO	NO	Less than screening level
Methyl tert-Butyl Ether	13	7.5	VW30-035	3.2	NA	862	173%	unlikely	YES		NO	Less than screening level
Methylene chloride	0.80	18	VW30-035	0.87	NA	1.2	4.44%	potentially	NO		NO	Less than background
o-Xylene	1.3	190	VW51-018	1.5	NA	169	0.68%	potentially	NO		NO	Less than background
Tetrachloroethene	1.5	1400	VW51-030	1.1	10.6	0.49	0.1%	potentially	YES	NO	YES	Less than WDI screening level
Toluene	8.6	40	VW51-030	5.2	212	107	22%	potentially	YES	NO	NO	Less than screening level
Trichlorofluoromethane	0.40	1.4	MP1-015	0.3	NA	131	29%	potentially	YES		NO	Less than screening level
Methane (ppmv)	39	743,000	MP2-015	2.5	12500	NA	0.0052%	potentially	YES	NO	NO	Less than screening level
TNMHC (ppmv)	12	31,000	VW51-018	10	NA	NA	0.039%	potentially	YES			

(1) Vapor wells VW30, VW51, MP1, and MP2 were used to evaluate soil gas near 9843 Greenleaf Avenue.

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Table 6-4
EVALUATION OF IN-BUSINESS AIR SAMPLING CONDUCTED AT 12811E LOS NIETOS ROAD
AUG 1997 THROUGH NOV 1998 SAMPLING

12811E Los Nietos Rd.	Maximum Indoor Air Conc (ppbv)	Maximum Soil Gas Conc Near Buildng (1)		Maximum Background Conc (ppbv)	WDI Indoor Air Screening Level (ppbv)	USEPA Residential Ambient Air PRG (ppbv)	Ratio of Air/Gas Concentration (%)	Is indoor air contaminant related to soil gas?	Is indoor air greater than background concentration?	Is indoor air greater than WDI screening level?	Is indoor air greater than residential PRG?	Comment regarding indoor air contaminant
		Max Conc (ppbv)	Vapor Well Probe									
1,1,1-Trichloroethane	1.4	ND		0.90	368	184	not in gas	NO	YES	NO	NO	Not detected in soil gas near building
1,2,4-Trimethylbenzene	9.2	44	VW55-018	2.3	NA	1.3	21%	potentially	YES		YES	**Potential concern. However, gas conc is low**
2-Butanone	14.0	NA		1.40	NA	340	NA	unknown	YES		NO	Less than screening level
Acetone	94	NA		5.6	312	156	NA	unknown	YES	NO	NO	Less than screening levels
Benzene	7.2	20	VW55-018	2.00	2.0	0.072	36%	potentially	YES	YES	YES	**Potential concern. However, gas conc is low**
Chloromethane	1.6	ND		2.70	NA	0.53	not in gas	NO	NO		YES	Not detected in soil gas near building
Ethylbenzene	6.4	ND		0.50	490	254	not in gas	NO	YES	NO	NO	Not detected in soil gas near building
m- & p- Xylene(s)	26	12	VW54-012	3.70	142.8	169	217%	unlikely	YES	NO	NO	Less than screening levels
Methyl tert-Butyl Ether	35	NA		3.20	NA	862	NA	unknown	YES		NO	Less than screening level
Methylene chloride	220	1.8	VW54-012	0.87	NA	1.2	12222%	unlikely	YES		YES	Air conc > soil gas, Commn lab contaminant
o-Xylene	8.6	ND		1.50	NA	169	not in gas	NO	YES		NO	Not detected in soil gas near building
Styrene	1.7	ND		ND	NA	259	not in gas	NO	YES		NO	Not detected in soil gas near building
Tetrachloroethene	11	11	VW55-018	1.10	10.6	0.49	100%	unlikely	YES	YES	YES	Soil gas not a likely source, air/gas ratio = 100%
Toluene	64	7.6	VW54-012	5.20	212	107	842%	unlikely	YES	NO	NO	Less than screening levels
Methane (ppmv)	3.5	30,000	VW55-018	2.5	12500	NA	0.012%	YES	YES	NO		Less than screening level
TNMHC (ppmv)	10	340	VW55-018	10	NA	NA	3%	YES	NO			

(1) Vapor wells VW54 and VW55 were used to evaluate soil gas near 12811E Los Nietos Road

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Table 6-5
EVALUATION OF IN-BUSINESS AIR SAMPLING CONDUCTED AT 12635 LOS NIETOS ROAD
AUG 1997 THROUGH NOV 1998 SAMPLING

12635 Los Nietos Rd. (1)	Maximum Indoor Air Conc (ppbv)	Maximum Soil Gas Conc Near Buildng (2)		Maximum Background Conc (ppbv)	WDI Indoor Air Screening Level (ppbv)	USEPA Residential Ambient Air PRG (ppbv)	Ratio of Air/Gas Concentration (%)	Is indoor air contaminant related to soil gas?	Is indoor air greater than background concentration?	Is indoor air greater than WDI screening level?	Is indoor air greater than residential PRG?	Comment regarding indoor air contaminant
		Max Conc (ppbv)	Vapor Well Probe									
1,1,1-Trichloroethane	3.0	4.5	VW60-008	0.90	368	184	67%	potentially	YES	NO	NO	Less than screening levels
1,1,2,2-Tetrachloroethane	1.0	ND		ND	NA	0.0048	not in gas	NO			YES	Not detected in soil gas near building
1,2,4-Trimethylbenzene (3)	12	22	VW61-019	2.3	NA	1.3	55%	potentially	YES		YES	**Potential concern. However, gas conc is low.**
1,3,5-Trimethylbenzene	4.0	ND		ND	NA	1.3	not in gas	NO			YES	Not detected in soil gas near building
2-Butanone	5.0	ND		1.4	NA	340	not in gas	NO	YES		NO	Not detected in soil gas near building
Acetone	1900	ND		5.6	312	156	not in gas	NO	YES	YES	YES	Not detected in soil gas near building
Benzene	6.0	1600	VW18-036	2.0	2.0	0.072	0.38%	potentially	YES	YES	YES	**Potential concern.**
Carbon Disulfide	6.5	ND		ND	NA	235	not in gas	NO			NO	Not detected in soil gas near building
Carbon tetrachloride	0.5	ND		ND	0.68	0.021	not in gas	NO		NO	YES	Not detected in soil gas near building
Chloroform	0.2	44	VW61-030	ND	3.4	0.017	0.45%	potentially		NO	YES	Less than WDI screening level.
Chloromethane	1.0	ND		2.7	NA	0.53	not in gas	NO	NO		YES	Not detected in soil gas near building
Dichlorodifluoromethane	8.1	1.1	VW60-030	0.70	NA	43	736%	unlikely	YES		NO	Less than screening levels
Ethylbenzene	9.0	ND		0.50	490	254	not in gas	NO	YES	NO	NO	Not detected in soil gas near building
m- & p- Xylene(s)	35	350	VW18-036	3.7	142.8	169	10%	potentially	YES	NO	NO	Less than screening levels
Methyl tert-Butyl Ether	54	ND		3.2	NA	862	not in gas	NO	YES		NO	Not detected in soil gas near building
Methylene chloride	4.3	12	VW60-008	0.87	NA	1.2	36%	potentially	YES		YES	Common lab contaminant
o-Xylene	13	1.0	VW60-030	1.5	142.8	169	1300%	unlikely	YES	NO	NO	Less than screening levels
Styrene	1.7	ND		ND	NA	259	not in gas	NO			NO	Not detected in soil gas near building
Tetrachloroethene	2.0	310	VW60-008	1.1	10.6	0.49	0.65%	potentially	YES	NO	YES	Less than WDI screening level.
Toluene	66	530	VW18-036	5.2	212	107	12.5%	potentially	YES	NO	NO	Less than screening levels
Trichloroethene	0.8	16	VW60-008	ND	8.2	0.21	5.0%	potentially		NO	YES	Less than WDI screening level.
Trichlorofluoromethane	1.0	ND		0.3	NA	131	not in gas	NO	YES		NO	Not detected in soil gas near building
Vinyl Chloride	0.5	340	VW61-019	ND	0.25	0.0086	0.15%	potentially		YES	YES	**Potential concern**
Methane (ppmv)	3.5	3900	VW61-019	2.5	12500	NA	0.090%	potentially	YES	NO		Less than WDI screening level.
TNMHC (ppmv)	12	11000	VW61-019	10	NA	NA	0.11%	potentially	YES			

(1) Business uses acetone. Stansell Brothers also uses cutting oils, lubricating oils, petroleum-grade solvents, and other industrial oils that may contain benzene, toluene, ethyl benzene, and xylenes.

(2) Vapor wells VW18, VW60, and VW61 were used to evaluate soil gas near 12635 Los Nietos Road.

(3) 1,2,4-Trimethylbenzene constitutes 40% of the C9 petroleum fraction that is used as a gasoline additive. Average air concentrations in the U.S.A range from 0.58 to 1.2 ppb in urban areas (USEPA Health Advisory, 198

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Table 6-6
EVALUATION OF IN-BUSINESS AIR SAMPLING CONDUCTED AT 12637A LOS NIETOS ROAD
AUG 1997 THROUGH NOV 1998 SAMPLING

12637A Los Nietos Rd.	Maximum Indoor Air Conc (ppbv)	Maximum Soil Gas Conc Near Buildng (1)		Maximum Background Conc (ppbv)	WDI Indoor Air Screening Level (ppbv)	USEPA Residential Ambient Air PRG (ppbv)	Ratio of Air/Gas Concentration (%)	Is indoor air contaminant related to soil gas?	Is indoor air greater than background concentration?	Is indoor air greater than WDI screening level?	Is indoor air greater than residential PRG?	Comment regarding indoor air contaminant
		Max Conc (ppbv)	Vapor Well Probe									
1,1,1-Trichloroethane	3.0	280	VW44-007	0.9	368	184	1.1%	potentially	YES	NO	NO	Less than screening levels
1,2,4-Trimethylbenzene	0.40	ND		2.3	NA	1.3	not in gas	NO	NO		NO	Not detected in soil gas near building
1,2-Dichloroethane	0.83	2.0	VW44-007	ND	3.6	0.018	42%	potentially		NO	YES	Less than WDI screening level
2-Butanone	1.9	9.6	VW11-035	1.4	NA	340	20%	potentially	YES		NO	Less than screening level
Acetone	17	100	VW44-007	5.6	312	156	17%	potentially	YES	NO	NO	Less than screening levels
Benzene	2.7	8.7	VW61-019	2.0	2.0	0.072	31%	potentially	YES	YES	YES	**Potential concern. However, gas conc is low.**
Chlorobenzene	0.60	ND		ND	NA	4.6	not in gas	NO			NO	Not detected in soil gas near building
Chloromethane	0.50	9.9	VW44-030	2.7	NA	0.53	5.1%	potentially	NO		NO	Less than background
Dichlorodifluoromethane	0.60	ND		0.70	NA	43	not in gas	NO	NO		NO	Not detected in soil gas near building
Ethylbenzene	0.50	0.76	VW44-016	0.50	490	254	66%	potentially	NO	NO	NO	Less than background
m- & p- Xylene(s)	1.7	3.9	VW44-007	3.70	142.8	169	44%	potentially	NO	NO	NO	Less than background
Methyl tert-Butyl Ether	4.4	6.2	VW11-035	3.20	NA	862	71%	potentially	YES		NO	Less than screening levels
Methylene chloride	4.0	3.8	VW44-007	0.87	NA	1.2	105%	unlikely	YES		YES	Air conc > soil gas, common lab contaminant
o-Xylene	0.40	4.2	VW44-007	1.5	142.8	169	9.5%	potentially	NO	NO	NO	Less than background
Styrene	2.0	ND		ND	NA	259	not in gas	NO			NO	Not detected in soil gas near building
Tetrachloroethene	0.92	40	VW61-008	1.1	10.6	0.49	2.3%	potentially	NO	NO	YES	Less than background
Toluene	4.7	48	VW61-030	5.2	212	107	9.8%	potentially	NO	NO	NO	Less than background
Trichlorofluoromethane	0.30	0.68	VW44-016	0.3	NA	131	44%	potentially	NO		NO	Less than background
Methane (ppmv)	3.9	18000	VW18-035	2.5	12500	NA	0.022%	potentially	YES	NO		Less than screening level
TNMHC (ppmv)	21	710	VW61-030	10	NA	NA	3.0%	potentially	YES			

(1) Vapor wells VW11, VW44, and VW61 were used to evaluate soil gas near 12637A Los Nietos Road.

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Table 6-7
EVALUATION OF IN-BUSINESS AIR SAMPLING CONDUCTED AT 12637B LOS NIETOS ROAD
AUG 1997 THROUGH NOV 1998 SAMPLING

12637B Los Nietos Rd.	Maximum Indoor Air Conc (ppbv)	Maximum Soil Gas Conc Near Buildng (1)		Maximum Background Conc (ppbv)	WDI Indoor Air Screening Level (ppbv)	USEPA Residential Ambient Air PRG (ppbv)	Ratio of Air/Gas Concentration (%)	Is indoor air contaminant related to soil gas?	Is indoor air greater than background concentration?	Is indoor air greater than WDI screening level?	Is indoor air greater than residential PRG?	Comment regarding indoor air contaminant
		Max Conc (ppbv)	Vapor Well Probe									
1,1,1-Trichloroethane	3.0	ND		0.9	368	184	not in gas	NO	YES	NO	NO	Not detected in soil gas near building
1,2,4-Trimethylbenzene	1.2	2.1	VW62-030	2.3	NA	1.3	57%	potentially	NO		NO	Less than background
2-Butanone	2.9	9.6	VW11-035	1.4	NA	340	30%	potentially	YES		NO	Less than screening level
Acetone	27	100	VW45-030	5.6	312	156	27%	potentially	YES	NO	NO	Less than screening levels
Benzene	1.7	2800	VW45-022	2.0	2.0	0.072	0.06%	potentially	NO	NO	YES	Less than background
Bromomethane	1.0	ND		ND	NA	1.3	not in gas	NO			NO	Not detected in soil gas near building
Carbon tetrachloride	1.0	ND		ND	0.68	0.021	not in gas	NO		YES	YES	Not detected in soil gas near building
Chloromethane	1.6	ND		2.7	NA	0.53	not in gas	NO	NO		YES	Not detected in soil gas near building
Dichlorodifluoromethane	0.50	ND		0.7	NA	NA	not in gas	NO	NO		NO	Not detected in soil gas near building
Ethylbenzene	0.40	230	VW45-022	0.5	490	254	0.17%	potentially	NO	NO	NO	Less than background
m- & p- Xylene(s)	3.3	350	VW45-022	3.7	142.8	169	0.94%	potentially	NO	NO	NO	Less than background
Methyl tert-Butyl Ether	4.7	6.2	VW11-035	3.2	NA	862	76%	potentially	YES		NO	Less than screening level
Methylene chloride	5.0	ND		0.87	NA	1.2	not in gas	NO	YES		YES	Not detected in soil gas near building
o-Xylene	1.0	300	VW45-022	1.5	NA	169	0.33%	potentially	NO		NO	Less than background
Tetrachloroethene	2.1	34	VW11-035	1.1	10.6	0.49	6.2%	potentially	YES	NO	YES	Less than WDI screening level
Toluene	12	770	VW45-022	5.2	212	107	1.6%	potentially	YES	NO	NO	Less than screening levels
Trichlorofluoromethane	0.30	ND		0.3	NA	131	not in gas	NO	NO		NO	Not detected in soil gas near building
Methane (ppmv)	3.3	213000	VW45-012	2.5	12500	NA	0.0015%	potentially	YES	NO		Less than screening level
TNMHC (ppmv)	9.4	34000	VW45-012	10	NA	NA	0.028%	potentially	NO			

(1) Vapor wells VW11, VW45, and VW62 were used to evaluate soil gas near 12637B Los Nietos Road.

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Table 6-8
EVALUATION OF IN-BUSINESS AIR SAMPLING CONDUCTED AT 9632 SANTA FE SPRINGS ROAD
AUG 1997 THROUGH FEB 1999 SAMPLING

9632 Santa Fe Springs Rd (1)	Maximum Indoor Air Conc (ppbv)	Maximum Soil Gas Conc Near Buildng (2) Max Conc (ppbv)	Maximum Soil Gas Conc Near Buildng (2) Vapor Well Probe	Maximum Background Conc (ppbv)	WDI Indoor Air Screening Level (ppbv)	USEPA Residential Ambient Air PRG (ppbv)	Ratio of Air/Gas Concentration (%)	Is indoor air contaminant related to soil gas?	Is indoor air greater than background concentration?	Is indoor air greater than WDI screening level?	Is indoor air greater than residential PRG?	Comment regarding indoor air contaminant
1,1,1-Trichloroethane	0.91	130	VW46-015	0.9	368	184	0.70%	potentially	YES	NO	NO	Less than screening levels
1,1-Dichloroethene	0.30	ND		ND	NA	0.01	not in gas	NO			YES	Not detected in soil gas near building
1,2,4-Trimethylbenzene	2.0	ND		2.3	NA	1.3	not in gas	NO	NO		YES	Not detected in soil gas near building
1,2-Dibromoethane (EDB)	0.53	ND		ND	0.06	0.0011	not in gas	NO		YES	YES	Not detected in soil gas near building
1,2-Dichlorobenzene	1.20	ND		1.1	NA	35	not in gas	NO	YES		NO	Not detected in soil gas near building
1,3,5-Trimethylbenzene	0.50	ND		ND	NA	1.3	not in gas	NO			NO	Not detected in soil gas near building
1,4-Dichlorobenzene	0.51	ND		0.36	NA	0.047	not in gas	NO	YES		YES	Not detected in soil gas near building
2-Butanone	6.1	3.3	VW46-027	1.4	NA	340	185%	unlikely	YES		NO	Less than screening levels
4-Methyl-2-pentanone	2.7	0.98	VW46-015	ND	NA	NA	276%	unlikely				Indoor air concentration > soil gas
Acetone	20	11	VW46-027	5.6	312	156	182%	unlikely	YES	NO	NO	Less than screening levels
Benzene	2.4	0.85	VW63-008	2.0	2.0	0.072	282%	unlikely	YES	YES	YES	Indoor air concentration > soil gas
Chloromethane	1.8	1.0	VW63-008	2.7	NA	0.53	180%	unlikely	NO		YES	Less than background
Dichlorodifluoromethane	0.70	ND		0.70	NA	43	not in gas	NO	NO		NO	Not detected in soil gas near building
Ethylbenzene	13	ND		0.5	490	254	not in gas	NO	YES	NO	NO	Not detected in soil gas near building
m- & p- Xylene(s)	45	1.9	VW46-015	3.7	142.8	169	2368%	unlikely	YES	NO	NO	Less than screening levels
Methyl tert-Butyl Ether	15	0.92	VW46-027	3.2	NA	862	1630%	unlikely	YES		NO	Less than screening levels
Methylene chloride	0.60	0.56	VW63-008	0.87	NA	1.2	107%	unlikely	NO		NO	Less than background
o-Xylene	21	ND		1.5	142.8	169	not in gas	NO	YES	NO	NO	Not detected in soil gas near building
Tetrachloroethene	1.0	400	VW46-027	1.1	0.49	0.49	0.25%	potentially	NO	YES	YES	Less than background
Toluene	15	3.4	VW63-008	5.2	212	107	441%	unlikely	YES	NO	NO	Less than screening levels
Trichloroethene	14	37	VW46-027	ND	8.2	0.21	38%	potentially		YES	YES	**Potential concern. However, gas conc is low.**
Trichlorofluoromethane	0.40	1.8	VW46-027	0.3	NA	131	not in gas	NO	YES		NO	Not detected in soil gas near building
Vinyl Chloride	0.20	ND		ND	0.25	0.0086	not in gas	NO		NO	YES	Not detected in soil gas near building
Methane (ppmv)	2.60	ND		2.5	12500	NA	not in gas	NO	YES	NO		Not detected in soil gas near building
TNMHC (ppmv)	7.30	106	VW46-027	10	NA	NA	6.9%	potentially	NO			Less than background

(1) Business used the 105 SAFETY-KLEEN SOLVENT, CALIFORNIA RECYCLED, which contains petroleum distillates, tetrachloroethene, 1,1,1-trichloroethane and detectable amounts of benzene, carbon tetrachloride, 1,4-dichlorobenzene, dichloroethane, toluene, and trichloroethene.

(2) Vapor wells VW46 and VW63 were used to evaluate soil gas near 9632 Santa Fe Springs Road.

laeval 2/8/01

Table 6-9
EVALUATION OF IN-BUSINESS AIR SAMPLING CONDUCTED AT 12633 LOS NIETOS ROAD
AUG 1997 THROUGH FEB 1999 SAMPLING

12633 Los Nietos Rd.	Maximum Indoor Air Conc (ppbv)	Maximum Soil Gas Conc Near Buildng (1)		Maximum Background Conc (ppbv)	WDI Indoor Air Screening Level (ppbv)	USEPA Residential Ambient Air PRG (ppbv)	Ratio of Air/Gas Concentration (%)	Is indoor air contaminant related to soil gas?	Is indoor air greater than background concentration?	Is indoor air greater than WDI screening level?	Is indoor air greater than residential PRG?	Comment regarding indoor air contaminant
		Max Conc (ppbv)	Vapor Well Probe									
1,1,1-Trichloroethane	0.2	34	VW18-035	0.9	368	184	0.6%	potentially	NO	NO	NO	Less than background and screening levels
1,2,4-Trimethylbenzene	1.0	48	VW18-035	2.3	NA	1.3	2.1%	potentially	NO		NO	Less than background and screening levels
1,3,5-Trimethylbenzene	0.3	46	VW18-035	ND	NA	1.3	0.7%	potentially			NO	Less than screening level
2-Butanone	2.1	ND	VW18-035	1.4	NA	340	not in gas	NO	YES		NO	Not detected in soil gas near building
Acetone	30.0	ND	VW18-035	5.6	312	156	not in gas	NO	YES	NO	NO	Not detected in soil gas near building
Benzene	9.4	1600	VW18-035	2.0	2.0	0.072	0.6%	potentially	YES	YES	YES	**Potential concern.**
Chloroform	2.0	820	VW18-035	ND	3.4	0.017	0.2%	potentially		NO	YES	Less than WDI screening level
Chloromethane	1.9	ND	VW18-035	2.7	NA	0.53	not in gas	NO	NO		YES	Not detected in soil gas near building
Dichlorodifluoromethane	1.0	ND	VW18-035	0.70	NA	43	not in gas	NO	YES		NO	Not detected in soil gas near building
Ethylbenzene	0.3	52	VW18-035	0.50	490	254	0.6%	potentially	NO	NO	NO	Less than background and screening levels
m- & p- Xylene(s)	3.1	500	VW18-035	3.70	142.8	169	0.6%	potentially	NO	NO	NO	Less than background and screening levels
Methyl tert-Butyl Ether	6.6	ND	VW18-035	3.20	NA	862	not in gas	NO	YES		NO	Not detected in soil gas near building
Methylene chloride	9.1	ND	VW18-035	0.87	NA	1.2	not in gas	NO	YES		YES	Not detected in soil gas near building
o-Xylene	1.2	ND	VW18-035	1.5	142.8	169	not in gas	NO	NO	NO	NO	Not detected in soil gas near building
Styrene	1.4	ND	VW18-035	ND	NA	259	not in gas	NO			NO	Not detected in soil gas near building
Toluene	6.3	530	VW18-035	5.2	212	107	1.2%	potentially	YES	NO	NO	Less than screening level
Trichlorofluoromethane	0.7	2.4	VW18-035	0.3	NA	131	29.2%	potentially	YES		NO	Less than screening level
Vinyl Acetate	6.7	ND	VW18-035	ND	NA	60	not in gas	NO		NO	NO	Not detected in soil gas near building
Methane (ppmv)	4.1	9.6	VW18-035	2.5	12500	NA	42.7%	potentially	YES	NO		Less than screening level
TNMHC (ppmv)	7.9	11000	VW18-035	10	NA	NA	0.1%	potentially	NO			

(1) Vapor well VW18 was used to evaluate soil gas near 12637A Los Nietos Road.

Section 7.0

7.0 SOIL VAPOR EXTRACTION TESTING

During 1998, the WDIG implemented a soil vapor extraction (SVE) testing program at the WDI site to provide site-specific data for SVE and to evaluate the feasibility of this technology as a remedial alternative for controlling soil gas at the site. The study was designed to additionally provide data regarding vapor treatment effectiveness and gas generation rates at the site.

As part of this subsurface gas evaluation, the results of the WDIG's SVE study were reviewed to assess the performance of the SVE testing and its applicability as a potential remedy component for controlling or reducing subsurface soil gas concentrations at the site. The following section provides a comprehensive summary of the testing activities and results and highlights the primary issues regarding performance and applicability of the SVE testing.

The results of the WDIG's SVE testing program were reported in *Technical Memorandum No. 9A - Soil Vapor Extraction Testing Report of Findings* (TRC, 1999c). The objectives of the SVE tests were to determine the following parameters in selected areas of the site:

- Air conductivity of the two layers above and below the gas-producing, sump-like material layer
- SVE radius of influence
- Flow versus vacuum ratios
- Long-term soil gas concentrations and rebound
- Condensate production
- Vapor extraction system and treatment effectiveness.

The SVE studies were conducted in five selected areas of the site, including Area 5, Area 7, Area 8, southwestern part of Area 2, and the western part of Area 2 (RV storage lot). The five test locations are shown on Figure 7-1.

Four of the five SVE test locations were selected based on the presence of buried wastes adjacent to on-site buildings. The SVE-test location in Area 8 was selected due to previously elevated levels of VOCs detected during previous soil gas sampling, even though the location is outside of the footprint of the buried wastes. A shallow extraction well and four monitoring wells (in the fill soils), and a deep extraction well, four monitoring wells and four air injection wells (in the native soils) were installed at the SVE test locations in Area 5, Area 2, Area 7, and Area 8. Only the shallow extraction well and four monitoring wells were installed at the test location in Area 2 (RV storage lot) due to the presence of a perched liquid zone in the deeper native soil zone. During installation of the wells and monitoring points, the soils encountered were fairly consistent. A silty sand/sandy silt layer at least 5 feet thick lies over the stained clays (the sump-like material).

7.1 SUMMARY OF TESTING ACTIVITIES

The testing of each SVE system in each of the five areas consisted of three phases: (1) determination of baseline conditions of extraction wells, (2) extraction, and (3) recovery.

Prior to the start-up of the SVE tests, the extraction wells were purged of two to three well volumes, or until a steady soil gas concentration was observed. The purged gas was monitored for oxygen, carbon dioxide, methane, and total non-methane organic compounds (NMOC). The SVE tests were initiated at low vacuum and flow levels and gradually increased to a maximum sustainable level for up to two weeks. The tests were performed until the methane levels decreased to less than one percent, or were observed to become asymptotic. SUMMA canister samples were collected on a regular basis during both the extraction and recovery phases of the test and analyzed for methane, oxygen, carbon dioxide, and total NMOC. At the end of the extraction phase, the extraction well was sampled and the system was shut down to allow for recovery and monitoring. Parameters were monitored daily and sampled for lab analyses for the first three days after shutdown. After the first three days, parameters were measured every 7 to 14 days. After 14 days, the system wells were monitored every 3 to 4 weeks until monitoring was terminated.

7.2 AREA 5 SVE TEST

<u>Shallow Zone SVE Results</u>

A summary of data observed during the shallow zone SVE test is presented in Table 7-1a, and includes data collected from various steps of the test. During the active portion of the SVE test:

- Methane levels increased from zero to 0.03% during startup then decreased to 0.0004% at shutdown
- Oxygen levels decreased from 9.4% at startup to 5.7%, then increased to 10.2% at shutdown

- Carbon dioxide levels increased from 2.8% at startup to 7.6%, then decreased to 6.1% at shutdown

- Benzene and vinyl chloride were not detected above the laboratory reporting limit during the active SVE test

- Total NMOC peaked at 1,050 ppmv during start-up, decreased to 131 ppmv, and decreased further to 35 ppmv at shutdown.

During the recovery phase of the test:

- Methane levels decreased from 0.0005% to 0.0002%, and to below the laboratory reporting limit (0.0002) with one detection of 0.0003% on August 18, 1998.

- Carbon dioxide levels decreased from 5.1% to 2%, then increased to 8%.

- Oxygen increased from 7.9% to 16.6% , then decreased to 7.9%

- Benzene increased from below the laboratory reporting limit (6 ppbv) to 92 ppbv, then decreased to below laboratory reporting limits; vinyl chloride was not detected above the laboratory reporting limit

- Total NMOC levels decreased from 176 ppmv to 37 ppmv.

USEPA contractor observation of monitoring revealed that the WDIG's contractors were not purging the wells prior to gas analysis. Potentially inaccurate readings could have been made in the deep four-inch well. After implementing USEPA's requirements for purging, the following were observed:

- Methane levels increased to 0.03%.

- Carbon dioxide levels increased to a maximum of 9.4%

- Oxygen levels increased to 8.3%, then decreased to 2.3%

Deep Zone SVE Results

A summary of data observed during the deep zone SVE test in Area 5 is presented in Table 7-1b, and includes data collected from various steps of the test. During the active portion of the SVE test:

- Methane levels increased from 2.2% at startup to 3.8% then decreased to 1.5%. There were 2 anomalous detections of 1.3 % and 0.4% that were due apparently to a sampling line leak and the opening of the air injection vents, respectively.

- Oxygen levels decreased from 9% initially to 1%, remained more or less constant at about 1% except for a couple of upward spikes, one (9.7%) an apparent line leak, the other (8.4%) when the air injection vents were opened. At shutdown, oxygen was 2.4%.

- Carbon dioxide was observed to increase from 7.4% to a maximum of 13.8%, then decreased to 8% due to an apparent line leak, increased to a maximum of 14.2%, then decreased to 12% at shutdown. Carbon dioxide also decreased when the air injection vents were opened.

- Benzene levels fluctuated throughout the active phase. Initially they were observed as non-detect (at a detection limit maximum of 260 ppbv, minimum of 33 ppbv), then increased to 170 ppbv, decreased to non-detect, then fluctuated between a high of 204 ppbv and low of 44 ppbv until the air injection vents were opened. Benzene then fell to 11.7%, increased to 96 ppbv and fell to 49 ppbv at shutdown.

- Vinyl chloride concentrations followed a similar pattern as benzene with initial observation of non-detect and then fluctuated between a maximum of 137 ppbv and non-detect, and 60 ppbv at shutdown.

- Total NMOC: Measured at 1,460 at start-up, decreased to 591 ppmv, levels gradually decreased to 243 ppmv on July 28, 1998, increased to 430 ppmv on July 30, decreased to 62 ppmv by August 4, then increased to 261 ppmv on August 6. At shutdown, Total NMOC levels decreased to 158 ppmv.

During the recovery phase of the test:

- Methane levels decreased from 1.6% to below 0.0001%, then increased to 1%

- Carbon dioxide levels increased from 5.8% to 11.4%, then decreased to 7.8%.

- Oxygen levels started at 2.4%, declined to 2%, then increased to 7.2%

- at the beginning of the recovery phase, benzene was 62 ppbv, next sample collected was below the laboratory reporting limit of 120 ppbv, the third sample was 77 ppbv, then decreased to 34 ppbv

- at the beginning of the recovery period, vinyl chloride was 64 ppbv, the next sample was below the laboratory reporting limit of 120 ppbv, the third sample was 37 ppbv, and further declined to 18 ppbv

- Total NMOC at the start of the recovery period was 158 ppmv, increased to 854 ppmv, then decreased to 706 ppmv

After implementing USEPA's requirements for purging, the following were observed:

- Methane levels increased to 2.3% then decreased to 1.6% at the end of the recovery monitoring period

- Carbon dioxide levels increased to 15.7% at the end of the recovery monitoring period

- Oxygen levels decreased from 7.2 % to 0 % at the end of the recovery monitoring period

7.3 AREA 2 SVE TEST

Shallow Zone SVE Results

A summary of data observed during the shallow zone SVE test is presented in Table 7-2a and includes data collected from various steps of the test. During the active portion of the SVE test:

- Methane levels increased from 0.03% at startup to a maximum of 0.3%, then decreased to 0.05%
- Oxygen levels increased from 13.3% at startup to a maximum of 20.9% at shutdown
- Carbon dioxide levels gradually declined from 5.78% at startup to 0.46% at shutdown
- Benzene was detected at startup at 110 ppbv, quickly decreased to 20 ppbv, then gradually decreased to 1 ppbv at shutdown
- Vinyl chloride was detected at startup at 140 ppbv, quickly decreased to 5.78 ppbv, then gradually decreased to 1.1 ppbv at shutdown
- Total NMOC at startup was 3,000 ppmv, quickly decreased to 150 ppmv, then decreased to 36 ppmv at shutdown.

During the recovery phase of the test:

- Methane levels decreased from 0.1% to 0.01%
- Carbon dioxide levels increased from 0.53% to 6.8%
- Oxygen initially decreased from 19.9% to 13.8% , then increased to 20.2%, after 7 days, it had decreased to 11.7%
- Benzene increased from 18 ppbv to 41 ppbv, then decreased to below laboratory reporting limits
- Vinyl chloride increased from 33 ppbv to 140 ppbv, then decreased to below laboratory reporting limits
- Total NMOC levels increased from 61 ppmv to a maximum of 670 ppmv, then declined to 29 ppmv

After implementing USEPA's requirements for purging, the following were observed in samples from the extraction well:

- Methane levels varied between zero and less than 0.01% throughout the remainder of the recovery phase

- Carbon dioxide levels decreased to 1.6%, then increased to 7.7%

- Oxygen levels increased from 10.5% to 19%, then decreased to 3.6%

Deep Zone SVE Results

A summary of data observed during the deep zone SVE test at Area 2 is presented in Table 7-2b and includes data collected from various steps of the test. During the active portion of the SVE test:

- Methane levels increased from 1.6% at startup to 3.38%, then slowly declined to 1% at shutdown

- Oxygen levels decreased at startup from 13.5% to 1.73%, then gradually increased to 4.77% at shutdown

- Carbon dioxide increased initially from 4.1% to a maximum of 18.2% percent, then slowly decreased to 14.1% at shutdown

- Benzene levels increased from below laboratory reporting limits at startup to 61 ppbv, then increased to a maximum of 180 ppbv, decreasing to 160 ppbv at shutdown

- Vinyl chloride concentrations increased from below laboratory reporting limits at startup to a maximum of 90 ppbv, fluctuated between 38 ppbv and 92 ppbv until shutdown when VC was recorded at 80 ppbv

- Total NMOC was measured at 5,800 ppmv at start-up, decreased quickly to a minimum of 840 ppmv, then increased to 2,700 ppmv, remaining fairly steady until decreasing to 1,600 ppmv at shutdown

During the recovery phase of the test:

- Methane levels decreased from 1% at the start of the recovery period to a minimum of 0.038%

- Carbon dioxide levels decreased from 14% to 1.2%.

- Oxygen levels increased from 6.08% to 19.2%

After implementing USEPA's requirements for purging, the following were observed:

- Methane levels ranged between zero and 0.6% at the end of the recovery monitoring period

- Carbon dioxide levels increased from 0.8% to 19.8% at the end of the recovery monitoring period

- Oxygen levels decreased from 19% to 0.6% at the end of the recovery monitoring period

7.4 AREA 7 SVE TEST

Shallow Zone SVE Results

A summary of data observed during the shallow zone SVE test at Area 7 is presented in Table 7-3a and includes data collected from various steps of the test. During the active portion of the SVE test:

- Methane levels increased from 0.44% during startup to 0.9% at maximum vacuum level achieved, then decreased to 0.05% at shutdown
- Oxygen levels increased from 1.79% at startup to a maximum of 9.24%, decreased to 7.8%, then increased to 8.4% at shutdown
- Carbon dioxide levels declined from 9.39% at startup to 6.8%, then fluctuated between 5.2% and 6.3% until shutdown when it was 6%
- Benzene was below laboratory reporting limits (maximum of 160 ppbv, minimum of 16 ppbv) for five sampling points, then increased to a maximum of 9.4 ppbv, followed by a gradual decrease to 5 ppbv at shutdown
- Vinyl chloride was below laboratory reporting limits throughout the active phase of the test except for one detection of 2.2 ppbv
- Total NMOC measured at 3,900 ppmv at startup, quickly decreased to 700 ppmv, then gradually decreased to 42 ppmv at shutdown

During the recovery phase of the test:

- Methane levels increased from 0.01% at the beginning of the recovery phase to 0.2%
- Carbon dioxide levels increased from 7.8% at the beginning of the recovery period to 11%
- Oxygen decreased from 4.1% at the beginning of the recovery period to 0.8%
- Benzene increased from 2.3 ppbv to a maximum of 19.4 ppbv, then decreased to 17 ppbv
- Vinyl chloride remained below the laboratory reporting limit until the last sample (2.4 ppbv)
- Total NMOC levels increased from 47 ppmv at the beginning of the recovery period to a maximum of 720 ppmv, then declined to 174 ppmv

After implementing USEPA's requirements for purging, the following were observed in samples from the extraction well:

- Methane levels ranged between zero and 0.2%, then decreased to 0.01% at the end of the recovery period
- Carbon dioxide levels decreased from 10% to 7.3% at the end of the recovery period
- Oxygen levels remained near 0% throughout the remainder of the recovery period

Deep Zone SVE Results

A summary of data observed during the deep zone SVE test at Area 7 is presented in Table 7-3b and includes data collected from various steps of the test. During the active portion of the SVE test:

- Methane levels decreased from 1.3% at startup to 1.1%, then slowly declined to 0.02% at shutdown
- Oxygen levels increased at startup from 1.39% to 7%, when the vacuum was increased, decreased to 1.7%, then gradually increased to 13.6% at shutdown
- Carbon dioxide increased from less than laboratory reporting limits initially to approximately 17%, then decreased to approximately 8% at shutdown
- Benzene levels remained below laboratory reporting limit (maximum of 13 ppbv) for two days, then increased to 2.7 ppbv, then decreased back to below laboratory reporting limits until shutdown
- Vinyl chloride concentrations remained below laboratory reporting limits (maximum of 16 ppbv) for two days, then increased to a maximum of 3.6 ppbv, then decreased back to below laboratory reporting limits at shutdown
- Total NMOC decreased from 750 ppmv at start-up to 54 ppmv at shutdown

During the recovery phase of the test:

- Methane levels ranged from below laboratory reporting limits (0.0002) to 0.05%
- Carbon dioxide levels initially decreased from 5.2% to 0.06%; for the remainder of the recovery period, carbon dioxide levels remained at, or below, 1.7%.
- Oxygen levels remained above 15%
- Benzene remained below the laboratory reporting limit for the entire recovery phase of the test

- Vinyl chloride remained below the laboratory reporting limit for the entire recovery period, except for the third day when it was detected at 6.7 ppbv

- Total NMOC increased from 29 ppmv to 390 ppmv, decreased to 78 ppmv, increased to 163 ppmv, then declined to 31 ppmv

After implementing USEPA's requirements for purging, the following were observed:

- Methane levels ranged from zero to 0.6%.

- Carbon dioxide levels increased to a maximum of 13.7%

- Oxygen levels decreased to zero after purging

7.5 AREA 8 SVE TEST

Shallow Zone SVE Results

A summary of data observed during the shallow zone SVE test at Area 8 is presented in Table 7-4a and includes data collected from various steps of the test. The SVE unit malfunctioned and was replaced after the first two sampling events. After replacement of the unit, during the active portion of the SVE test:

- At startup, methane level was 0.004%, increased to 0.02% when the vacuum was increased, then decreased to 0.004%, increased to 0.01%, then decreased to 0.003% at shutdown

- Oxygen at startup was 6.4% and continued to increase to 19.1% at shutdown

- Carbon dioxide levels decreased from 13.5% at startup to 1.3% at shutdown

- Benzene and vinyl chloride were not detected above laboratory reporting limits for the entirety of the active SVE phase

- Total NMOC started at 346 ppmv at startup, then decreased to below laboratory reporting limits at the end of the test

During the recovery phase of the test:

- Methane levels decreased to below the laboratory reporting limit and remained there until the last sample was collected, methane increased to 0.0003%

- Carbon dioxide levels increased from 0.3% to 7%

- Oxygen decreased from 20.1% to 8.4%

- Benzene and vinyl chloride remained below the laboratory reporting limits for the recovery phase of the test

- Total NMOC levels increased from 11 ppmv to 32 ppmv

After implementing USEPA's requirements for purging, the following were observed in samples from the extraction well:

- Methane levels increased from zero to 1.9%, then decreased back to zero at the end of the recovery period

- Carbon dioxide levels increased from 7.8% to 16.8%, then decreased to 10.1% at the end of the recovery period

- Oxygen levels remained near 0%

Deep Zone SVE Results

A summary of data observed during the deep zone SVE test at Area 7 is presented in Table 7-4b and includes data collected from various steps of the test. During the active portion of the SVE test:

- Methane level at startup was 0.0007% and increased to 0.0186%

- Oxygen levels decreased at startup from 9% to 8.8%, then decreased to 7.4% at shutdown

- Carbon dioxide gradually increased from 12.3% at startup to 13.3% at shutdown

- Benzene and vinyl chloride remained below the laboratory reporting limit for the entire test

- Total NMOC at startup were 35 ppmv and decreased to 28 ppmv at shutdown

During the recovery phase of the test:

- Methane levels decreased from 0.149% to 0.0013%

- Carbon dioxide levels decreased from 13.2% to 5%

- Oxygen levels increased from 7.6% to 15.2%, then decreased slightly to 14.7%

- Benzene and vinyl chloride remained below the laboratory reporting limits for the entire recovery phase of the test

- Total NMOC increased from 78 ppmv to 596 ppmv

After implementing EPA's requirements for purging, the following were observed:

- Methane levels remained between 0.1% and 0.2%.
- Carbon dioxide levels decreased to 4.7%, then increased to 5.5%
- Oxygen levels increased to 13.1%, then decreased to 9.6%

7.6 AREA 2 (RV Lot) SVE TEST

A summary of data observed during the shallow zone SVE test at Area 2 (RV storage lot) is presented in Table 7-5 and includes data collected from various steps of the test. During the active portion of the SVE test:

- Methane levels increased from 0.047% at startup to 1.3%, then decreased to 0.03% at shutdown
- Oxygen increased from 10.3% at startup to 20.6% at shutdown
- Carbon dioxide levels increased from 4.7% at startup to 0.09% at shutdown
- Benzene decreased from 51.8 ppbv at startup to 1.9 ppbv at shutdown
- Vinyl chloride increased initially from 5 ppbv at startup to 28 ppbv, then decreased to below the laboratory reporting limit at shutdown
- Total NMOC decreased from 149 ppmv at startup to 8 ppmv at shutdown

During the recovery phase of the test:

- Methane levels increased from 0.0065% to 0.685%
- Carbon dioxide levels increased from 0.198% to 3%
- Oxygen decreased gradually from 20.4% to 14.4%
- Benzene increased from 12.1 ppbv to 67.8 ppbv and then decreased to 39.1 ppbv
- Vinyl chloride increased from non-detect to 7.1 ppbv, then decreased to 3 ppbv
- Total NMOC increased from 42 ppmv to a maximum of 128 ppmv, then decreased to 102 ppmv

After implementing USEPA's requirements for purging, the following were observed in samples from the extraction well:

- Methane levels remained at 0%
- Carbon dioxide levels increased slightly to 2.7%
- Oxygen levels decreased slightly to 11.4%

7.7 WDIG's EVALUATION OF SVE TESTING

Several assumptions were made in WDIG's evaluation of the SVE testing data:

- radial symmetry was assumed due to cylindrical shape of extraction well
- permeability is isotropic throughout the zone of influence
- time is removed as a variable; assumed a steady state equilibrium or rate of mass removal equals rate of soil gas generation within the volume of influence
- SVE volume of influence is assumed to be isothermal for the period of each test.

7.7.1 Zone of Influence

The estimated zone, or radius of influence (ROI) calculated by the WDIG for each of the 9 tests are included in each of Tables 7-1a and -1b, -2a and -2b, -3a and -3b, -4a and -4b, and -5. Based on these estimated zones of influences, the following observations were made by the WDIG in relation to the SVE zone of influence:

- the shallow zones demonstrated limited zones of influence due to vertical air filtration and preferential pathways that can reduce the effective zone of influence
- the deep zones demonstrated larger zones of influence ranging from 122 feet to 200 feet likely due to:
  1) lithology in the deeper zones indicate a potential for higher permeabilities
  2) the deep SVE zones are covered by the lower permeability waste layer that acts to increase the effective vacuum by preventing vertical leakage during SVE
  3) the native soils are less likely to exhibit preferential flow due to utilities or other reasons of disturbance than are the shallow soils

The WDIG concluded that based on the SVE data compiled during these tests and the zone of influence calculations, SVE using conventional extraction techniques (<100 inches water column) and equipment is able to generate a zone of influence of greater than 30 feet in the shallow fill soils and a greater zone of influence, from 122 feet to 200 feet in the deeper native soils. The radius of pressure influence as computed by the WDIG is generally appropriate for control of soil gas migration.

7.7.2 Soil Gas Recovery

During the soil gas recovery phase of the SVE testing, the WDIG observed that the treated areas appeared to go through three phases as follows:

- No activity: After discontinuation of the active phase of the test, the methane, oxygen, and carbon dioxide levels remained relatively stable
- Aerobic phase: During this phase, carbon dioxide levels increased, and oxygen levels decreased slightly, consistent with aerobic degradation of petroleum hydrocarbons
- Anaerobic phase: After increase of carbon dioxide and decrease of oxygen levels, low levels of methane were observed to increase gradually consistent with anaerobic degradation of petroleum hydrocarbons

The shallow soils exhibited very low methane levels and slightly elevated carbon dioxide and oxygen levels decreased during the rebound period as expected. For the deep soils, methane levels increased only slightly during rebound as compared with the shutdown levels. Oxygen levels decreased (as is expected during biodegradation) at all of the areas except Area 8 where oxygen levels increased slightly. Carbon dioxide levels increased (also expected during biodegradation) in all areas except Area 8 where carbon dioxide decreased slightly.

7.7.3 SVE Modeling

Vertical and horizontal intrinsic permeability of the soil was modeled by the WDIG using GASSOLVE. This modeling program also provides a statistical evaluation of error range of the permeability estimate. In order to calculate the intrinsic permeability using the GASSOLVE model, the following parameters and default values were used:

PARAMETER	INPUT VALUE
Formation	Open (shallow) Leaky (deep)
Time Dependency	Steady
Volumetric Flow Rate	from SVE data (cubic feet per minute)
Local Atmospheric pressure	1.0 Standard Atmospheres (default)
Gas Viscosity	0.18×10^{-4} pascals-seconds (default)
Volumetric Gas Content	0.200
Formation Thickness	From SVE data and boring logs
Depth to Top of SVE Extraction well	From SVE data and boring logs
Depth to Bottom of SVE Extraction well	From SVE data and boring logs

The horizontal and vertical permeabilities (both in meters^2), the residual sum of squares and the average error (%) are output for each set of data.

The calculation of intrinsic permeability by GASSOLVE was checked through laboratory measurements on soil samples and calculations using those measurements. Air was pushed through each soil sample and the pressure difference measured. The resultant extraction flow was measured and used to compute the effective air conductivity. The moisture content of the soil samples was then combined with the calculated effective gas conductivity to calculate intrinsic permeability. The laboratory based calculation of intrinsic permeability is lower than that derived using GASSOLVE by a factor of 16. The difference is due to the uncertainties in the data measured during the SVE tests and used in GASSOLVE and in the laboratory samples.

The WDIGs GASSOLVE results for the shallow SVE tests indicated:

- Horizontal permeabilities ranged from 1.8×10^{-8} m^2 in the Area 5 tests to 6.2×10^{-12} in the Area 7 tests, indicating a low permeability soil type consistent with silty sands
- Vertical permeabilities were generally on the same order of magnitude as for the horizontal permeabilities, indicating surface leakage
- Soil types based on calculated permeabilities compare similarly with soil types determined from drill cuttings in the field

GASSOLVE results for the deep SVE tests indicated:

- Horizontal permeabilities ranged from 5.4×10^{-11} m^2 in the Area 2-SW tests to 8.9×10^{-11} in the Area 5 tests, indicating a slightly more permeable soil type than for the shallow soils, but is still considered a low permeability soil type
- Vertical permeabilities were generally 2 to 4 orders of magnitude lower than the horizontal permeabilities, indicating marginal air surface leakage
- Soil types based on calculated permeabilities compare similarly with soil types determined from drill cuttings in the field

7.7.4 Gas Generation Evaluation

The WDIG used SVE test data to calculate methane generation based on its concentration in the extraction flow for both the shallow and deep soil zones. The half-life for anaerobic decomposition was assumed to be 50 years, the sump-like materials were represented by a generic alkane midway in the range of hydrocarbons found at the site and assumed to anaerobically decompose into methane and carbon dioxide. Using the amount of total petroleum hydrocarbons measured in the sump-like material, the total yield of methane from a unit mass would be 0.25 standard cubic feet (scf) per pound. Application of a model to these conditions derives a generation rate of 3.3×10^{-6} scf per minute (scfm) per square foot of surface area above the sump-like material, or 2.4 scfm of methane from the 16.7 acres of the site underlain by sump-like materials. If the half-life were only 25 years, the overall methane generation would only increase to 2.5 scfm.

The WDIG concluded that the low gas generation rate in the sump-like materials is incapable of causing enough upward or outward migration of methane and other constituents to be a health risk to people working in on-site businesses or offsite residences and schools.

7.7.5 SVE Performance Evaluation

To evaluate SVE performance, constant rate performance tests were conducted by the WDIG under steady-state conditions to ensure that a representative area of influence is determined. Relatively stable flow conditions were produced with the exception of the Area 7 wells that exhibited very low flows due to the low permeability of the soils.

As a result of the SVE testing and GASSOLVE modeling of the gas recovery data, sufficient data was obtained regarding wellhead flow and vacuum and soil gas characteristics to allow for design of an SVE system at the WDI site. No effects were observed on groundwater levels in the test areas. Based on these results, the WDIG concluded that it has been shown that sufficient vacuum and air flow can be maintained in order to prevent or control migration of soil gas constituents.

7.7.6 Gas Recovery Estimates

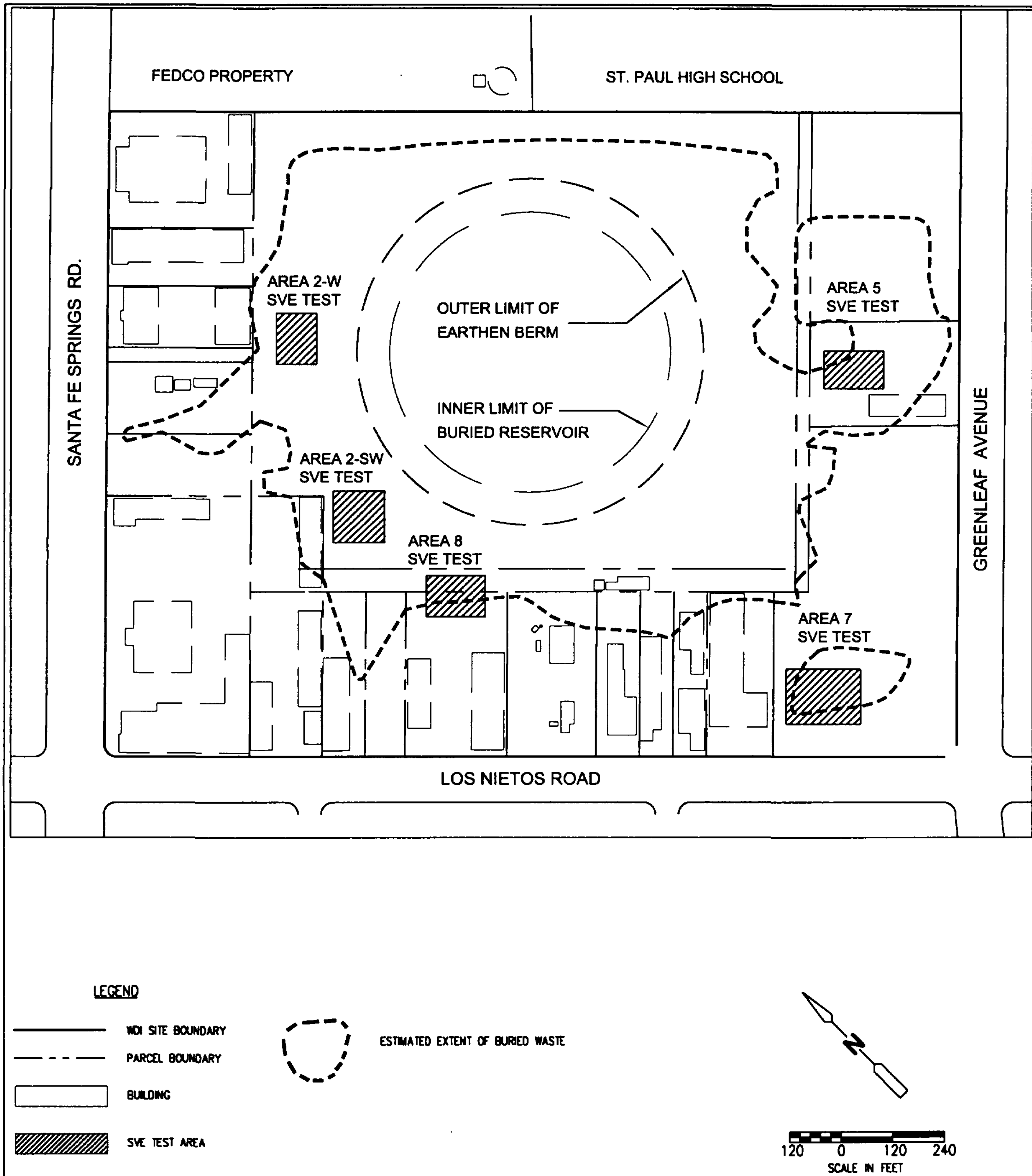
The WDIG also calculated an estimate of the mass of methane, benzene, and vinyl chloride extracted during SVE treatment. For the shallow soils, methane removal ranged between 0.14 pounds (Area 5) and 4.2 pounds (Area 7), benzene removal ranged between zero (Area 5 and Area 8) and 7×10^{-5} pounds (Area 2), and vinyl chloride removal ranged between zero (Area 5, Area 7, and Area 8) and 2×10^{-5} (Area 2). For the deep soils, methane removal ranged between 0.17 pounds (Area 8) and 977 pounds (Area 7), benzene removal ranged between zero (Area 8) and 0.019 pounds (Area 5), and vinyl chloride removal ranged between zero (Area 8) and 0.0128 pounds (Area 5).

7.7.7 SVE Gas Treatment Evaluation

The WDIG also conducted an evaluation of the off-gas treatment technology. Sufficient data was collected on the gas stream to allow for design of the most appropriate gas treatment process. Destruction efficiency ranged from zero to approximately 60%. Reasons for the lower than expected treatment levels may be due to a combination of low contaminant concentrations, low oxygen contamination, and low catalytic oxidizer temperature.

7.8 CONCLUSIONS

The SVE tests at all locations demonstrated that the technology can be applied to the WDI site to remove subsurface gases, prevent movement of soil gas away from the site, and control soil gas near buildings. During the tests, concentrations of methane and VOCs were significantly reduced. Sampling of soil gas concentrations after the extraction was completed showed that the rate of increase relative to the pre-test concentrations was slow, indicating that the potential for gas production is less than most typical municipal landfills. The use of SVE as a gas control remedy will be further evaluated in the Supplemental Feasibility Study.



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Soil Vapor Extraction Test Areas
Waste Disposal Inc. Site
Santa Fe Springs, California

Figure 7-1

Table 7-1a
SUMMARY OF AREA 5 SVE RESULTS, SHALLOW ZONE TEST
EXTRACTION WELL SVW-1

SAMPLE TYPE DATE/TIME PARAMETERS	INITIAL 7/15/98 0830	MID-WAY 7/15/98 1700	FINAL 7/17/98 0900	RECOVERY 9/10/98 0845
METHANE (%)	0	0.01	0.0004	0.0002
O2 (%)	9.4	7	10.2	7.9
CO2 (%)	2.8	7	6.1	8
BENZENE (ppbv)	<7	<6	<0.8	<2.2
VINYL CHLORIDE (ppbv)	<7	<6	<0.8	<2.2
TCE (ppbv)	<7	<6	<0.8	<2.2

ESTIMATED ROI: 37 feet

Table 7-1b
SUMMARY OF AREA 5 SVE RESULTS, DEEP ZONE TEST
EXTRACTION WELL DVW-1

SAMPLE TYPE DATE/TIME PARAMETERS	INITIAL 7/20/98 0800	MID-WAY 7/24/98 0800	FINAL 8/7/98 0900	RECOVERY 9/10/98 0845
METHANE (%)	2.2	3.3	1.5	1
O2 (%)	9	1	2.4	7.2
CO2 (%)	7.4	13.8	12	7.8
BENZENE (ppbv)	<260	85	49	33
VINYL CHLORIDE (ppbv)	<260	57	58	18
TCE (ppbv)	<260	136	67	49

ESTIMATED ROI: 176 feet

Table 7-2a
SUMMARY OF AREA 2-SW SVE RESULTS, SHALLOW ZONE TEST
EXTRACTION WELL SVW-1

SAMPLE TYPE DATE/TIME PARAMETERS	INITIAL 7/22/98 930	MID-WAY 7/22/98 1530	FINAL 7/24/98 0900	RECOVERY 9/10/98 0930
METHANE (%)	0.03	0.3	0.05	0.01
O2 (%)	13.3	17	20.9	11.7
CO2 (%)	5.8	3	0.46	6.8
BENZENE (ppbv)	110	26	3.3	<2.4
VINYL CHLORIDE (ppbv)	140	6.5	1.1	<2.4
TCE (ppbv)	<38	1.3	0.47	2.7

ESTIMATED ROI: could not be evaluated, estimated at 30 feet

Table 7-2b
SUMMARY OF AREA 2-SW SVE RESULTS, DEEP ZONE TEST
EXTRACTION WELL DVW-1

SAMPLE TYPE DATE/TIME PARAMETERS	INITIAL 7/28/98 0800	MID-WAY 7/29/98 1530	FINAL 8/7/98 0730	RECOVERY 9/10/98 0930
METHANE (%)	1.6	1.53	1	0.0676
O2 (%)	13.5	3.65	4.77	18.9
CO2 (%)	4.1	15.2	14.1	1.2
BENZENE (ppbv)	<130	17	160	<2.2
VINYL CHLORIDE (ppbv)	<160	90	82	<2.2
TCE (ppbv)	<74	<7.4	<38	<2.2

ESTIMATED ROI: > 200 feet

Table7-3a
SUMMARY OF AREA 7 SVE RESULTS, SHALLOW ZONE TEST
EXTRACTION WELL SVW-1

SAMPLE TYPE DATE/TIME PARAMETERS	INITIAL 8/10/98 0815	MID-WAY 8/11/98 1530	FINAL 8/17/98 0730	RECOVERY 9/16/98 0915
METHANE (%)	0.44	0.7	0.05	0.2
O2 (%)	1.79	8	8.4	0.8
CO2 (%)	9.39	5.4	6	11
BENZENE (ppbv)	<160	9.2	5	17
VINYL CHLORIDE (ppbv)	<200	556	<1.5	2.4
TCE (ppbv)	<94	<3.8	<1.5	<1.8

ESTIMATED ROI: 37 feet

Table 7-3b
SUMMARY OF AREA 7 SVE RESULTS, DEEP ZONE TEST
EXTRACTION WELL DVW-1

SAMPLE TYPE DATE/TIME PARAMETERS	INITIAL 8/12/98 0735	MID-WAY 8/15/98 1900	FINAL 8/24/98 0900	RECOVERY 9/16/98 0915
METHANE (%)	1.3	0.3	0.02	0.0291
O2 (%)	1.39	2.4	13.6	20
CO2 (%)	16.7	14	7.9	0.3
BENZENE (ppbv)	<13	2.7	<1.5	<1.6
VINYL CHLORIDE (ppbv)	<16	2.6	<1.5	<1.6
TCE (ppbv)	<7.5	1.7	12.2	<1.6

ESTIMATED ROI: >200 feet

Table 7-4a
SUMMARY OF AREA 8 SVE RESULTS, SHALLOW ZONE TEST
EXTRACTION WELL SVW-1

SAMPLE TYPE DATE/TIME PARAMETERS	INITIAL 9/10/98 1600	MID-WAY 9/14/98 0845	FINAL 9/16/98 1030	RECOVERY 10/2/98 0645
METHANE (%)	0.004	0.004	0.003	0.0003
O2 (%)	6.4	15.3	19.1	8.4
CO2 (%)	13.5	5	1.3	7
BENZENE (ppbv)	<3	1.5	<1.8	<0.8
VINYL CHLORIDE (ppbv)	<3	1.5	<1.8	<0.8
TCE (ppbv)	<1.7	3	<1.8	1.3

ESTIMATED ROI: 32 feet

Table 7-4b
SUMMARY OF AREA 8 SVE RESULTS, DEEP ZONE TEST
EXTRACTION WELL DVW-1

SAMPLE TYPE DATE/TIME PARAMETERS	INITIAL 9/17/98 1000	MID-WAY 9/17/98 1400	FINAL 9/18/98 1500	RECOVERY 10/6/98 1020
METHANE (%)	<0.0007	0.0018	0.0186	0.0013
O2 (%)	9	8.8	7.4	14.7
CO2 (%)	12.3	12.9	13.3	5
BENZENE (ppbv)	<1.4	<1.5	<1.5	<12
VINYL CHLORIDE (ppbv)	<1.4	<1.5	<1.5	<12
TCE (ppbv)	30.5	28.3	22.5	<12

ESTIMATED ROI: 122 feet

Table 7-5
SUMMARY OF AREA 2-W SVE RESULTS, SHALLOW ZONE TEST
EXTRACTION WELL SVW-1

SAMPLE TYPE DATE/TIME PARAMETERS	INITIAL 9/23/98 0750	MID-WAY 9/23/98 1315	FINAL 9/25/98 0830	RECOVERY 10/6/98 1045
METHANE (%)	0.047	0.7	0.03	0.685
O2 (%)	10.3	18.4	20.6	14.6
CO2 (%)	4.7	1	0.09	3
BENZENE (ppbv)	51.8	26	1.9	39.1
VINYL CHLORIDE (ppbv)	5	21.6	<0.7	3
TCE (ppbv)	<2.8	<1.7	<0.7	<1.5

ESTIMATED ROI: 24 feet

Section 8.0

8.0 REFERENCES

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